ELMSTEAD ENERGY ASSESSMENTS AND BUILDING SERVICES

19 Menelik Road

London, NW2 3RJ

Energy and Sustainability Statement

Elmstead Energy Assessments & Building Services
Suite 3 Aster House, Lanswoodpark
Elmstead Market, Colchester
Essex, CO7 7FD
Registered Company: 11606546

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1.0 Executive Summary

EEABS (Elmstead Energy Assessments & Building Services) were instructed to produce an Energy and Sustainability Statement for the proposed development of two new dwellings located at 19 Menelik Road, London NW2 3RJ.

This energy and Sustainability statement can be used as a supporting document to the planning application to demonstrate that the overall energy and Sustainability strategy of the proposed development will meet the requirements set out by Building Regulations and local Camden Planning Policy.

Relevant Planning Policies

From inspection of the relevant policies for the proposed development we consider that the following targets needs to be met in order to comply with Part L Building Regulations and local Camden Planning Polices.

- As it is not a major development, the new dwellings should only have to achieve a pass under the latest Part L 2021 Building Regulations requirement to meet the Camden requirement of at least a 19% CO2 emissions reduction in comparison to Part L 2013 standards.
- The development will also consider other areas of sustainability within its design such as overheating, flood risk, waste, air quality, and materials to provide a low energy and sustainable design overall.

Assessment Methodology

This assessment has been carried out by following a Be Lean, Be Clean, and Be Green Energy Hierarchy.

To calculate the estimated carbon emissions of the development we have used Design SAP 10.2 software which is approved by Building Regulations. The baseline Target Emission Rate (TER) is calculated in accordance with Appendix R from the SAP 10.2 methodology.

SAP 10.2 is the very latest methodology which assesses a dwelling to the recently released (as of June 2022) Part L 2021 Building regulations. The Part L 2021 Building Regulations target represents an approximate 30% carbon reduction in comparison to the Part L 2013 standards.

The appraisals within this strategy are based on the Building Regulations Part L (2021) calculation methodology and should not be understood as a predictive assessment of likely future energy requirements or otherwise.

Be Lean

Savings have been made at the Be Lean stage thanks to increased performance of the building's constructions and air permeability.

Be Clean

Savings have also been realised through the use of efficient lighting and ventilation systems. However, due to the small size of the development the possibility of connecting to an Area Wide Heat Network, other secondary heat source, or using a combined heat and power system (CHP) to provide heating and hot water have all been deemed technically unfeasible.

Be Green

From brief assessment of the various renewable technologies available we concluded that an Air Source Heat Pump system providing the dwellings heating and hot water would be the most feasible renewable technology to install.

Overall Energy Assessment Results

Table 1 - Overall Carbon Emission Results

Unit	Baseline CO2 Emissions (Tonnes of CO2)	Proposed CO2 Emissions (Tonnes of CO2)	Carbon Savings
Dwelling 1 - 19A	1.60	0.65	59.38%
Dwelling 2 - 19B	1.73	0.62	64.16%
Total	3.33	1.27	61.86%

The results show that under the proposed design the total carbon emissions would be 1.27 tonnes CO2, compared to 3.33 tonnes CO2 for the Baseline. This would be an overall improvement of 61.86% over the Part L 2021 Standard. As the Part L 2021 standard is already an approximate 30% improvement over the 2013 Part L regulations, the Camden planning requirement of at least a 19% reduction in comparison to the 2013 Part L standard would be comfortably satisfied.

The proposed dwellings would also receive very good EPC ratings of at least a B, indicating that they will have affordable running costs to the future occupants. They will also have excellent Environmental Impact Ratings of an A, demonstrating that they are very environmentally friendly.

The SAP Calculation sheets for the proposed dwellings can be found within Appendix A.

Sustainability Measures

In collaboration with the Energy Assessment of the development, an analysis of the overheating within the dwellings has also been carried out following the cooling hierarchy of the London Plan.

By following the overheating/cooling strategy the risk of internal overheating to the dwellings would be minimised. Once through planning, at later design stages when the specification of the dwellings is more detailed a full CIBSE TM59 Part O overheating assessment can be carried out to show compliance with Part O Building Regulations.

All taps, toilets, and showers etc. will be specified that are considered to be low water use. The water usage for the dwellings will not exceed a maximum of 110 litres/person/day (105 litres/person/day internal usage and 5 litres/person/day external) as required by the advanced

optional requirement of Part G of the Building Regulations and the Camden Local Plan. Calculations to prove this can be carried out once specific sanitaryware has been selected.

Additional water saving measures such as ensuring the dwellings are on a water meter and garden rainwater butts will also be installed.

Any demolition will be recycled where possible. A demolition audit will be carried out before any works progress on site to identify which materials can be recycled.

The development will also consider the concept of the waste hierarchy in both the demolition of any structures and when constructing the proposed dwellings.

The Contractor will also be encouraged to meet the standards of the Considerate Constructors Scheme which requires, amongst other things, that dust emissions, noise pollution, and the potential for ground contamination are minimised during demolition and construction phases.

The intention will be to minimise waste as much as possible through careful consideration of materials and construction methodologies chosen. Wherever possible only manufacturers that can demonstrate that their products are sustainably sourced and fabricated will be used.

The specific materials selected will be confirmed between the architect/contractor and the client, every effort will be made to use only sustainable materials with a high degree of recyclability.

The extent of possible flooding on the site has also been analysed using data from the government flood warning information service. The flood map shows that the proposed development site appears to be within Flood Zone 1.

The surface water flood map shows that the proposed site sits within an area of low risk from surface water flooding. The final drainage design should ensure that peak flow and volume of water run-off for the proposed site will be no worse than that of the site prior to development.

The development will have electric heating systems in the form of air source heat pumps which have no harmful on-site emissions in comparison to gas boilers that have various pollutants within their flue gases.

The property is located nearby to a number of bus stops and Cricklewood Train station, encouraging the use of public transport systems, and reducing the requirement for cars, easing congestion. The site has a good PTAL Rating of 2. There will be no car parking spaces offered on the site, but there is space allocated for enclosed bicycle storage, helping to further promote more sustainable travel methods.

Conclusion

This energy and sustainability statement has shown that the proposed development two new dwellings located at 19 Menelik Road, London NW2 3RJ would satisfy the energy and sustainability requirements of Building Regulations and Local Camden Planning Policies.

2.0 Introduction

EEABS (Elmstead Energy Assessments & Building Services) were instructed to produce an Energy and Sustainability Statement for the proposed development of two new dwellings located at 19 Menelik Road, London NW2 3RJ.

This energy and Sustainability statement can be used as a supporting document to the planning application to demonstrate that the overall energy and Sustainability strategy of the proposed development will meet the requirements set out by Building Regulations and Camden Local Planning Policy.

Proposed floor plans and elevations can be seen below. Please see the architectural submittal documents for full details.

Figure 1 - Proposed Floor Plans and Elevations

2.1 Planning Policy Context

Numerous policies that relate to the energy efficiency and carbon emissions of the development have been considered in preparation of this energy assessment.

2.1.1 National Planning Policy Framework

The National Planning Policy Framework encourages local planning authorities to adopt proactive strategies to mitigate and adapt to climate change.

They should plan for new development in ways which reduce greenhouse gas emissions; actively support energy efficiency improvements to existing buildings; and set local sustainability requirements which are consistent with the government's policies and standards.

2.1.2 Building Regulations Part L 2021

The assessment of the development against policy targets has been carried out using the very latest Part L 2021 benchmarks. The Part L 2021 targets represent approximately a 30% reduction in carbon emissions in comparison to the Part L 2013 target.

Part L 2021 is mandatory and requires that a dwelling does not exceed the CO2 emission rate of that set by a Target Emission Rate (TER) calculated in accordance with Appendix R from the SAP 10.2 methodology.

It also requires that a dwelling does not exceed the Target Fabric Energy Efficiency (TFEE) and Target Primary Energy Rate (TPER).

2.1.3 The London Plan

The latest London Plan guidance on the preparation of Energy Assessments is from June 2022 and has been used to structure this energy statement.

As this development is not more than 10 units it is not considered as a major development and therefore the requirements of the London Plan should not strictly apply, however the guidance will still be followed, and every effort will be made to ensure the most energy efficient and carbon minimal design possible.

Policy SI 2 of the London Plan requires development proposals to make the fullest contribution to minimising carbon dioxide emissions through on site methods in accordance with the following energy hierarchy:

- Be lean: use less energy
- Be clean: supply energy efficiently
- Be green: use renewable energy

London Plan Policy SI4 also states that developments should minimise the potential for overheating by assessing the cooling hierarchy of the development.

2.1.4 London Borough of Camden

The Camden Local Plan (2017) Policy CC1 Climate Change Mitigation states that all developments should minimise the effects of climate change and encourage developments to meet the highest feasible environmental standards that are financially viable.

Developments should reduce their carbon dioxide emissions through following the steps in the energy hierarchy and major developments should demonstrate that the London Plan targets have been achieved.

As this development is not a major development (only two new build dwellings) it is not considered as a major development under the London Plan, however section 8.8 of the Camden Local Plan does state that new residential developments should demonstrate at least a 19% reduction in CO2 emissions below Part L 2013 Building Regulations.

As the new Part L 2021 Building Regulations standard is an approximate 30% improvement over the Part L 2013 target, the Camden requirement will be met just by showing compliance with the latest Part L 2021 regulations.

The development will also consider other areas of sustainability within its design such as overheating, flood risk, water usage, waste, air quality, and materials to provide a low energy and sustainable design overall.

3.0 Assessment Methodology

The following methodology has been used to calculate the CO2 emissions for the development.

3.1 SAP 10.2

To calculate the estimated carbon emissions of the development we have used Design SAP 10.2 software which is approved by Building Regulations. The baseline Target Emission Rate (TER) is calculated in accordance with Appendix R from the SAP 10.2 methodology.

SAP 10.2 is the very latest methodology which assesses a dwelling to the recently released (as of June 2022) Part L 2021 Building regulations. The Part L 2021 Building Regulations target represents an approximate 30% carbon reduction in comparison to the Part L 2013 standards.

3.2 Limitations

The appraisals within this strategy are based on the Building Regulations Part L (2021) calculation methodology and should not be understood as a predictive assessment of likely future energy requirements or otherwise.

Occupants may operate their systems differently, and/or the weather may be different from the assumptions made by Part L approved calculation methods, leading to differing energy requirements once the development is in operation.

4.0 Energy Assessment

The following sections describe how each stage of the Energy Hierarchy have been modelled and how their associated Carbon Emissions have been calculated.

4.1 Baseline Target

The baseline Target Emission Rate (TER) is calculated in accordance with Appendix R from the SAP 10.2 methodology. This Baseline CO2 emission rate is then used as the basis for the target CO2 reductions required throughout the Energy Hierarchy.

Table 2 - Baseline Carbon Emission Results

Unit	Area (m2)	CO2 Emission Rate (kgCO2/m2)	Total CO2 Emissions (Tonnes of CO2)
Dwelling 1 - 19A	169	9.47	1.60
Dwelling 2 - 19B	169	10.23	1.73
		Total	3.33

The results show that the total Target CO2 emissions for the development is estimated to be 3.33 Tonnes of CO2 per annum.

4.2 Proposed Design - Following the Energy Hierarchy

4.2.1 Be Lean

The Be Lean stage of the energy hierarchy focuses on passive design measures which are those which reduce the initial energy demand of the building through passive means, for example wall insulation once installed requires no other means of operation and its performance is also unlikely to deteriorate.

Where possible the development has taken a fabric first approach to reducing the initial energy demand by the following methods:

Glazing Performance

Windows and glazed doors are be highly efficient glazing and will have a low U-value of 1.20 W/m^2.K, helping to reduce the amount of heat loss through the glazing.

Thermal Envelope

The inclusion of high levels of thermal insulation not only helps to reduce the buildings overall energy demand and therefore carbon emissions, but it also plays a vital role in securing the occupant's thermal comfort.

It also helps to reduce the buildings peak heating load required meaning that smaller plant equipment can be sized, helping to further improve not only carbon emissions but also the cost of the development.

The proposed walls, floor, and roofs will provide significant savings over the Part L1 limiting fabric parameters.

Thermal Bridging

Thermal bridges are junctions between parts of the build through which heat can escape, for example the junction where a roof and wall construction meet.

To reduce heat loss through these areas we have assumed that Government approved thermal bridging details will be followed. (Individual Psi values assumed for each of the junctions can be found within the SAP calculation sheets within the appendices.)

Air Permeability

The air permeability of the development is a measure of how much volume of air can penetrate through its fabric. Therefore, a well built, highly sealed building would result in less unwanted heat loss, and therefore provide a more efficient building.

Part L 2021 Building Regulations have a maximum limit of 8 $m^3/h.m^2$ that must be achieved, the proposed development will target a value of 5.01 $m^3/h.m^2$.

Summary of Passive Design Measures

The table below shows a summary of the passive design measures included for within the development and how they compare against the Part L1 requirements.

Table 3 - Summary Table of Passive Design Measures

Parameter	Part L Limiting Values	Development Proposal	% Improvement
U-Values			
Walls	0.26 W/m^2.K	0.18 W/m^2.K	31%
Floors	0.18 W/m^2.K	0.13 W/m^2.K	28%
Roofs	0.16 W/m^2.K	0.13 W/m^2.K	19%
Glazing	1.60 W/m^2.K	1.20 W/m^2.K	25%
Air Permeability	8 m^3/h.m^2	5.01 m^3/h.m^2	37%

The summary of passive measures shows that the proposed development will be a considerable improvement over the Part L1 limiting fabric parameters.

4.2.2 Be Clean

The Be Clean Stage of the Energy Hierarchy focuses on energy efficiency measures which are those which seek to supply the remaining demand for energy, after the initial demand has been lowered through passive means, in the most efficient way.

The following energy efficiency measures have been incorporated within the proposed development:

Heating and Hot Water

Due to the small size of the development the possibility of connecting to an Area Wide Heat Network, other secondary heat source, or using a combined heat and power system (CHP) to provide heating and hot water have all been deemed technically unfeasible.

Better results can be more easily achieved through the use of renewable technologies. (To be discussed under the Be Green Stage of the Energy Hierarchy)

Lighting

The lighting for the development will consist of low energy LED lighting throughout with a minimum light source efficacy of at least 100 lm/W.

Ventilation

The ventilation is assumed to be natural through the use of opening windows, this reduces energy costs and carbon emissions associated with whole house mechanical ventilation systems. Wet rooms and kitchen areas will have local intermittent mechanical extract ventilation.

4.2.3 Be Green

The Be Green stage of the energy hierarchy focuses on on-site low and zero carbon renewable technologies.

The table below provides a brief analysis of the different renewables and low carbon technologies considered for the site and comments on their overall feasibility.

Table 4 - Low Carbon and Renewable Technologies Analysis

Low Carbon or Renewable Technology	Comments	Feasible
Air Source Heat Pumps	ASHPs can be used to provide both heating and hot water. With a high Seasonal Coefficient of Performance (SCOP) the benefit of a providing heating from an ASHP could outweigh the use of a gas boiler. ASHP also have a greater air quality than that of boilers as no harmful emissions are produce don site.	Yes
Ground Source Heat Pumps	Ground Source Heat Pumps are usually more efficient than ASHP as the temperature of the ground is more stable throughout the year. However, the installation of Ground Source is complex, requiring a lot of free ground area, and would not be economically or practically feasible for this project.	No
Photovoltaic Solar Panels	PV panels are a simple to install technology that can produce green electricity with very little ongoing maintenance. However, the available roof space that could situated PV Panels is limited.	No
Solar Hot Water Panels	Solar Hot Water Panels would also need to be installed on the roof of the development and the amount of free space is limited.	No
Biomass Boiler	A biomass boiler uses wood chips/pellets and would need a constant supply. A large storage area would be required to store the fuel on the site. There are also concerns with local air quality.	No
Wind Turbines	Large wind turbines would be required to produce any significant electrical savings. As the development is close to existing buildings the installation of any such turbine would be unfeasible.	No

From brief assessment of the various renewable technologies available we can see that Air Source Heat Pump systems would be the most feasible renewable technology to install.

Air Source Heat Pump

For the proposed dwellings we have assumed that air source heat pumps would be installed to serve the heating and hot water requirements. The heat pump has a seasonal efficiency of 300% (SCOP 3.00).

(Once an exact manufacturer/model of heat pump is selected the actual efficiencies values can be used.)

4.2.4 Proposed Design Results

The results below show total carbon emissions in kgCO2/m2 and tonnes CO2 for the proposed design following the energy hierarchy as previously described.

Table 5 - Proposed Design Carbon Emission Results

Unit	Area (m2)	CO2 Emission Rate (kgCO2/m2)	Total CO2 Emissions (Tonnes of CO2)
Dwelling 1 - 19A	169	3.86	0.65
Dwelling 2 - 19B	169	3.67	0.62
		Total	1.27

The results show that under the proposed design the total carbon emissions would be 1.27 tonnes CO2, compared to 3.33 tonnes CO2 for the Baseline. This would be an overall improvement of 61.86% over the Part L 2021 Standard. As the Part L 2021 standard is already an approximate 30% improvement over the 2013 Part L regulations, the Camden planning requirement of at least a 19% reduction in comparison to the 2013 Part L standard would be comfortably satisfied.

The proposed dwellings would also receive very good EPC ratings of at least a B, indicating that they will have affordable running costs to the future occupants. They will also have excellent Environmental Impact Ratings of an A, demonstrating that they are very environmentally friendly.

The SAP Calculation sheets for the proposed dwellings can be found within Appendix A.

5.0 Sustainability

5.1 Overheating/Climate Change Adaptability

In collaboration with the Energy Assessment of the development, an analysis of the overheating within the dwellings has also been carried out.

1. Minimise Internal Heat Gains

To minimise internal heat gains low energy lighting will be used throughout the development. Any new heating pipework will also be well insulated, white goods and computer equipment should also be of the highest efficiency.

2. Reduce the Amount of Heat Entering the Building

Highly efficient windows will reduce the amount of solar gain entering the dwellings.

3. Use of Thermal Mass and High Ceilings to Manage Heat within the Building

The building will have a medium thermal mass and it will be well insulated with an improved air permeability value to stop heat from first entering the building.

4. Passive Ventilation

Windows will be openable to allow for fresh air when required.

5. Mechanical Ventilation

A whole house Mechanical supply and extract ventilation system has not been proposed at this stage in order to keep energy consumption to as low as possible. One could be considered further into the detailed design stage if required.

By following the above overheating/cooling strategy the risk of internal overheating to the dwellings would be minimised. Once through planning, at later design stages when the specification of the dwellings is more detailed, a full CIBSE TM59 Part O overheating assessment can be carried out to show compliance with Part O Building Regulations.

5.2 Water Efficiency

All taps, toilets, and showers etc. will be specified that are considered to be low water use.

The water usage for the dwellings will not exceed a maximum of 110 litres/person/day (105 litres/person/day internal usage and 5 litres/person/day external) as required by the advanced optional requirement of Part G of the Building Regulations and the Camden Local Plan.

Calculations to prove this can be carried out once specific sanitaryware has been selected. The table below provides typical consumption figures for each fitting in order to satisfy the optional requirement.

Table 2.2 Maximum fittings consumption optional requirement level

Water fitting	Maximum consumption
WC	4/2.6 litres dual flush
Shower	8 l/min
Bath	170 litres
Basin taps	5 l/min
Sink taps	6 l/min
Dishwasher	1.25 l/place setting
Washing machine	8.17 l/kilogram

Figure 2 - Maximum Fittings Consumption for Water Efficiency

Installation Type	Make	Specification	Unit of Measure	Capacity / Flow Rate	Use Factor	Fixed Use (litres/person/day)	Litres/person/day
WC (dual flush)	TBC	TBC (Recommended Figures Used)	Full Flush Volume (litres)	4.2	1.46	0	6.132
			Part Flush Volume (litres)	2.6	2.96	0	7.696
Taps (excluding kitchen / utility room taps)	TBC	TBC (Recommended Figures Used)	Flow Rate (litres / minute)	5	1.58	1.58	9.48
Bath (where shower also	TBC	TBC (Recommended Figures	Capcity to Overflow (litres)	170	0.11	0	18.7
Shower (where bath also present)	TBC	TBC (Recommended Figures Used)	Flow Rate (litres / minute)	8	4.37	0	34.96
Kitchen / Utility Room Sink	TBC	TBC (Recommended Figures Used)	Flow Rate (litres / minute)	6	0.44	10.36	13
Washing Machine	TBC	TBC (Default Figures Used)	Litres / kg Dry Load	8.17	2.10	0	17.157
Dishwasher	TBC	TBC (Default Figures Used)	Litres / Place Setting	1.25	3.60	0	4.5
						Total Calculated Use (litres / person / day)	111.625
						Contribution from Greywater (litres / person / day)	0
						Contribution from Rainwater (litres / person / day)	0
						Normalisation Factor	0.91
						Total Internal Water Consumption (litres / person / day)	101.6
						External Water Use (litres / person / day)	5
						Overall Total Water Consumption (litres / person / day)	**106.6**

Figure 3 - Water Efficiency Calculation (To be Updated once Specific Sanitaryware is known)

Additional water saving measures such as ensuring the dwellings are on a water meter and garden rainwater butts will also be installed.

5.3 Land Use and Waste

Any demolition will be recycled where possible. A demolition audit will be carried out before any works progress on site to identify which materials can be recycled.

The development will also consider the concept of the waste hierarchy shown below in both the demolition of any structures and when constructing the proposed dwellings.

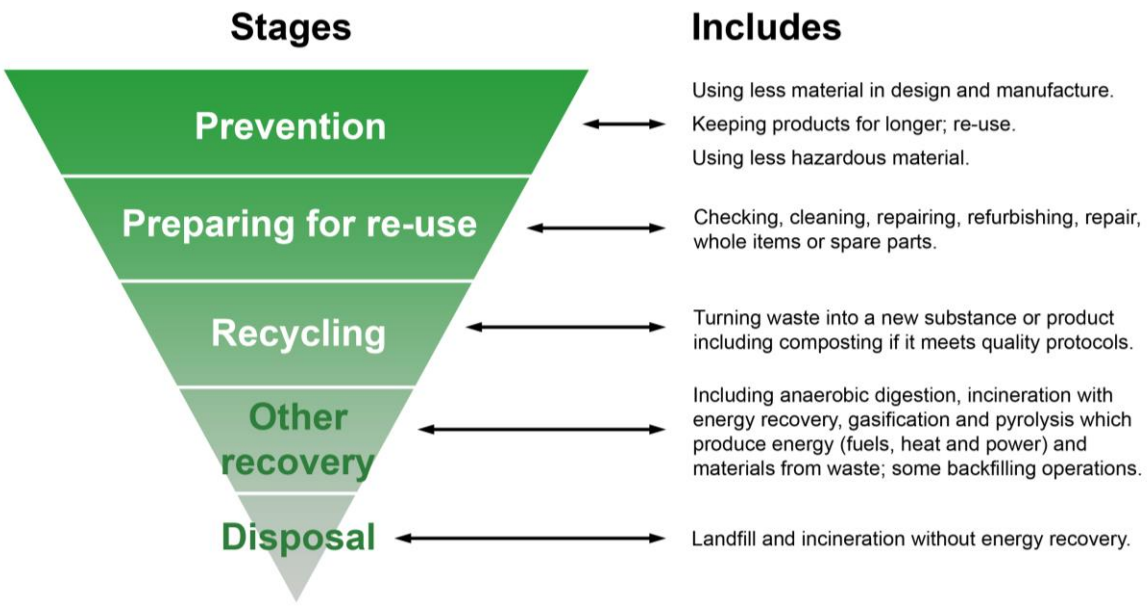

Figure 4 - Waste Hierarchy Diagram

The Contractor will also be encouraged to meet the standards of the Considerate Constructors Scheme which requires, amongst other things, that dust emissions, noise pollution, and the potential for ground contamination are minimised during demolition and construction phases.

5.4 Materials

The intention will be to minimise waste as much as possible through careful consideration of materials and construction methodologies chosen. Wherever possible only manufacturers that can demonstrate that their products are sustainably sourced and fabricated will be used.

The specific materials selected will be confirmed between the architect/contractor and the client, every effort will be made to use only sustainable materials with a high degree of recyclability.

5.5 Flood Risk

The extent of possible flooding on the site has also been analysed using data from the government flood warning information service. The flood map shows that the proposed development site appears to be within Flood Zone 1.

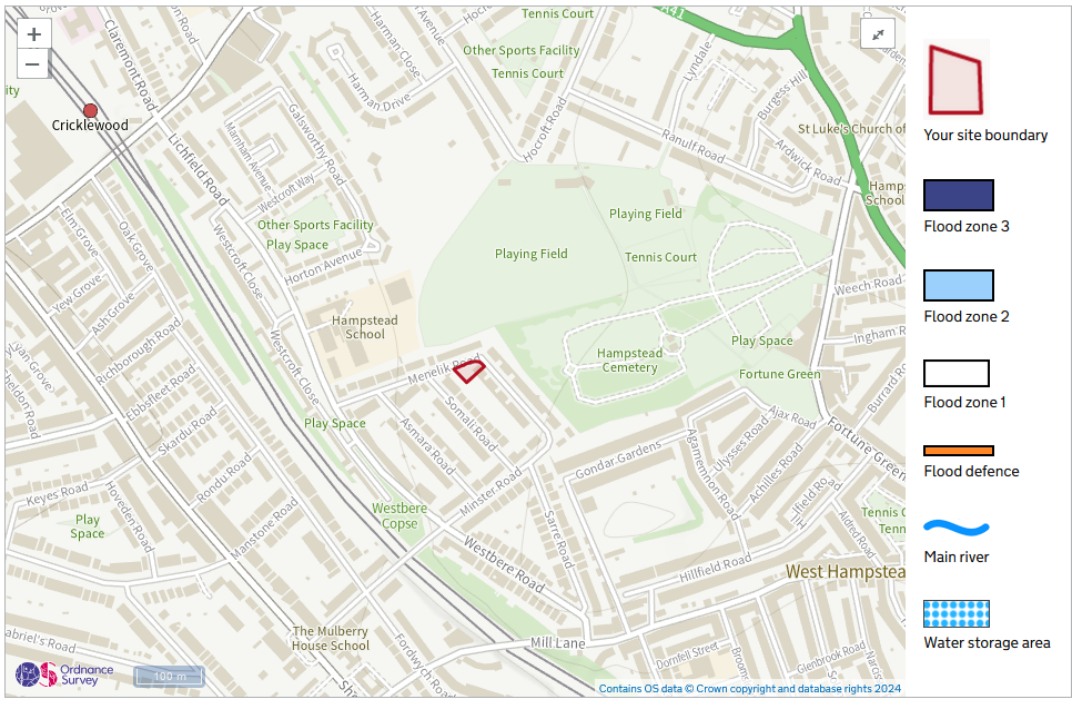

Figure 5 - Flood Risk Map for the Site

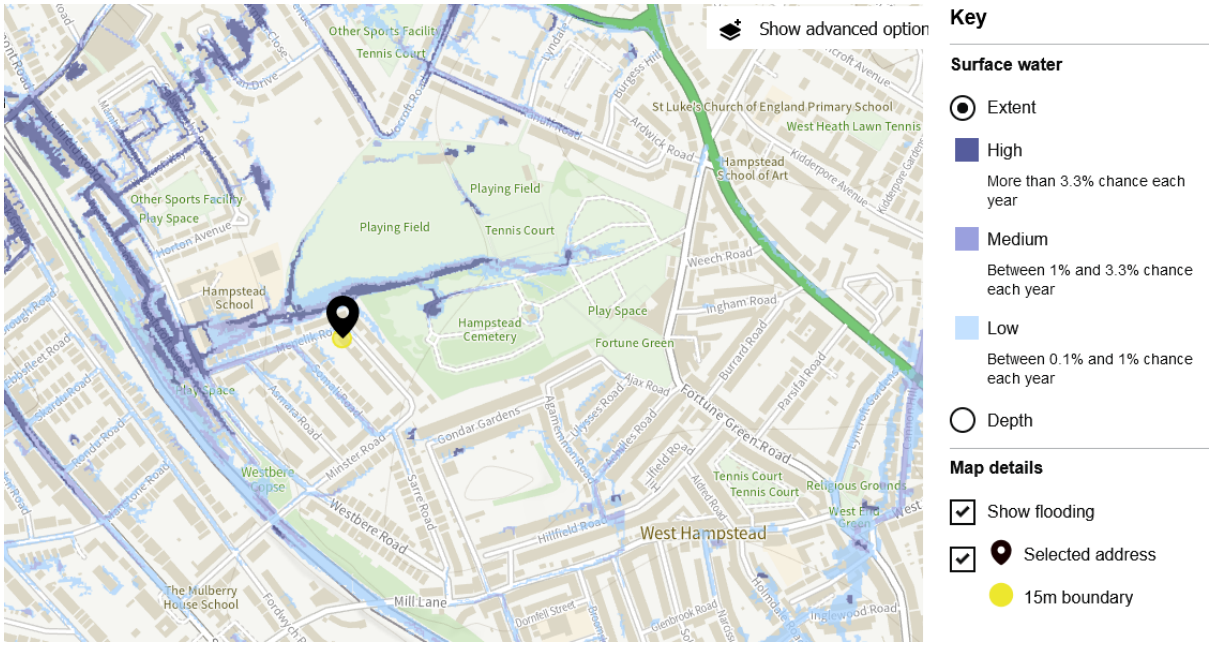

Figure 6 - Surface Water Map for the Site

The surface water flood map shows that the proposed site sits within an area of low risk from surface water flooding. The final drainage design should ensure that peak flow and volume of water run-off for the proposed site will be no worse than that of the site prior to development.

5.6 Air Quality

The development will have electric heating systems in the form of air source heat pumps which have no harmful on-site emissions in comparison to gas boilers that have various pollutants within their flue gases.

As mentioned, the Contractor will also be encouraged to meet the standards of the Considerate Constructors Scheme which requires, amongst other things, that dust emissions, noise pollution, and the potential for ground contamination are minimised during demolition and construction phases.

5.7 Transport

The property is located nearby to a number of bus stops and Cricklewood Train station, encouraging the use of public transport systems, and reducing the requirement for cars, easing congestion. The site has a good PTAL Rating of 2. There will be no car parking spaces offered on the site, but there is space allocated for enclosed bicycle storage, helping to further promote more sustainable travel methods.

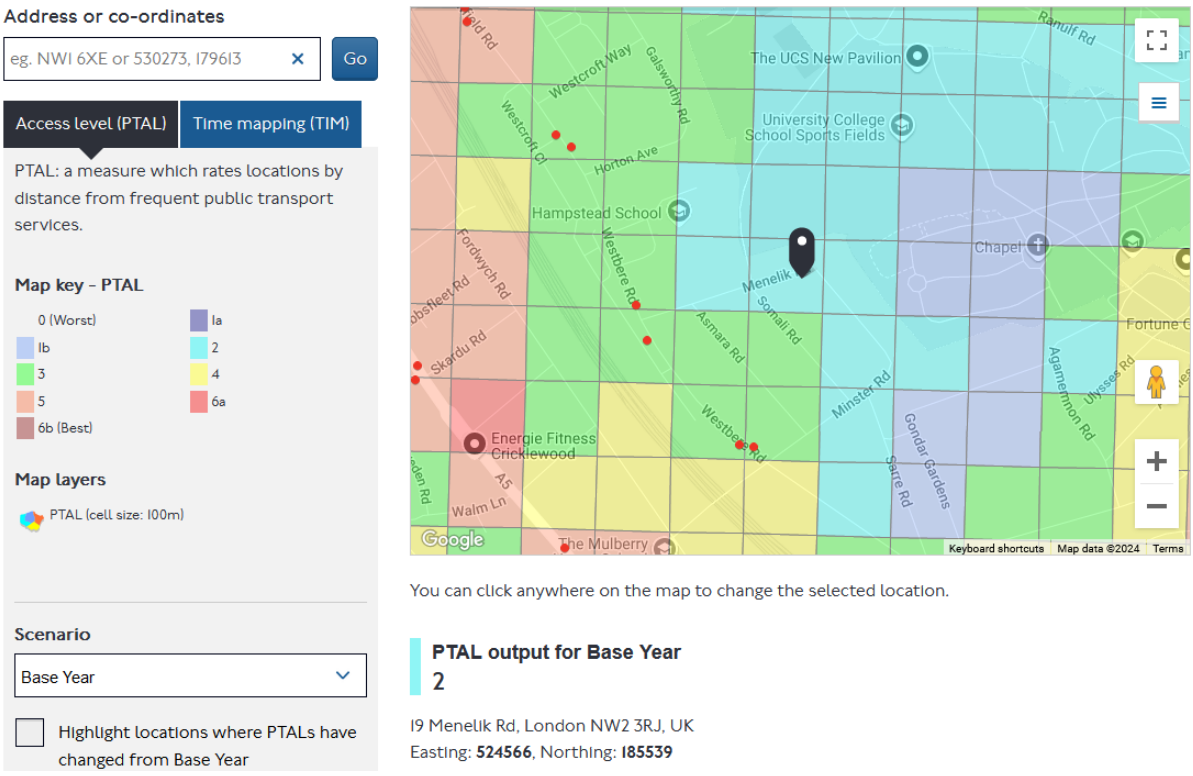

Figure 7 - PTAL Rating

Appendix A - Part L SAP 2021 Calculation Sheets and Predicted Energy Assessments

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Mon 02 Dec 2024 15:53:20

Project Information			
Assessed By	Darren Coham	Building Type	House, Semi-detached
OCDEA Registration	EES/022007	Assessment Date	2024-12-02

Dwelling Details			
Assessment Type	As designed	Total Floor Area	169 m^2
Site Reference	19A	Plot Reference	19a
Address	19a Mendelik Road, NW2 3RJ		

Client Details	
Name	RT Architectural Consultants
Company	RT
Address	39 Wakemans Hill Avenue, London, NW9 0TA

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.47 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.86 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*49.61 kWh_{PE}/m^2*	
Dwelling primary energy	40.32 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*42.2 kWh/m^2*	
Dwelling fabric energy efficiency	41.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.18	Walls (1) (0.18)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.13	Heatloss Floor 1 (0.13)	OK
Roofs	*0.16*	0.13	Roof (2) (0.14)	OK
Windows, doors, and roof windows	*1.6*	1.2	BF1 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	93.70575	0.18
Sheltered wall: Walls (2)	45.7	0.17
Exposed wall: Walls (3)	12.92	0.18
Party wall: Party Wall (1)	69.82	0 **(!)**
Ground floor: Heatloss Floor 1, Heatloss Floor 1	80.27	0.13
Exposed roof: Roof (1)	26.799999999999997	0.11
Exposed roof: Roof (2)	27.69	0.14
Exposed roof: Roof (3)	24.156	0.14

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
BF1, windows	10.494	South West	0.75	1.2
FW1, windows	1.305	South West	0.75	1.2
FW1, windows	1.305	South West	0.75	1.2
FW1, windows	1.305	South West	0.75	1.2
SW1, windows	5.67	South West	0.75	1.2
W1, windows	1.19625	North West	0.75	1.2
FW2, windows	1.19625	North West	0.75	1.2
FW2, windows	1.19625	North West	0.75	1.2

Name	Area [m^2]	Orientation	Frame factor	U-Value [W/m^2K]
SW2, windows	1.19625	North West	0.75	1.2
ED, door	2.222	North	N/A	1.2
W3, windows	5.046	North East	0.75	1.2
W2, windows	1.19625	North West	0.75	1.2
FW3, windows	5.046	North East	0.75	1.2
FW4, windows	1.16	North East	0.75	1.2
RL, roof windows	0.812	North East	0.75	1.2
RL, roof windows	0.812	North East	0.75	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Government-approved scheme	0.236	
External wall	E3: Sill	Government-approved scheme	0.022 **(!)**	
External wall	E4: Jamb	Government-approved scheme	0.017 **(!)**	
External wall	E5: Ground floor (normal)	Government-approved scheme	0.058	
External wall	E6: Intermediate floor within a dwelling	Government-approved scheme	0.001 **(!)**	
External wall	E16: Corner (normal)	Government-approved scheme	0.042	
External wall	E18: Party wall between dwellings	Government-approved scheme	0.032 **(!)**	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	
External wall	E14: Flat roof	Government-approved scheme	0.06	
Party wall	P1: Ground floor	Government-approved scheme	0.043	
Party wall	P4: Roof (insulation at ceiling level)	Government-approved scheme	0.04	
Party wall	P2: Intermediate floor within a dwelling	SAP table default	0 **(!)**	
External wall	E10: Eaves (insulation at ceiling level)	Government-approved scheme	0.057	
External wall	E12: Gable (insulation at ceiling level)	Government-approved scheme	0.043	
External wall	E13: Gable (insulation at rafter level)	Government-approved scheme	0.043	
External wall	E11: Eaves (insulation at rafter level)	Government-approved scheme	0.018 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	5.01 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity

Efficiency	301.6%
Emitter type	Both radiators and underfloor
Flow temperature	45°C
System type	Heat Pump
Manufacturer	Daikin Europe NV
Model	EBLA14DA3V3
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water		
Cylinder/store - type: Cylinder		
Capacity	200 litres	
Declared heat loss	2 kWh/day	
Primary pipework insulated	Yes	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	100 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	19A	**Issued on Date**	02/12/2024
Assessment Reference	19a	**Prop Type Ref**	19A
Property	19a, Mendelik Road, London, NW2 3RJ		

SAP Rating	81 B	**DER**	3.86	**TER**	9.47
Environmental	96 A	**% DER < TER**			59.24
CO_2 Emissions (t/year)	0.59	**DFEE**	41.32	**TFEE**	42.23
Compliance Check	See BREL	**% DFEE < TFEE**			2.17
% DPER < TPER	18.73	**DPER**	40.32	**TPER**	49.61

Assessor Details	Mr. Darren Coham	**Assessor ID**	R789-0001
Client	RT, RT Architectural Consultants		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.2700 (1b)	x	2.7500 (2b)	=	220.7425	(1b) - (3b)
First floor	57.7100 (1c)	x	2.9300 (2c)	=	169.0903	(1c) - (3c)
Second floor	30.9100 (1d)	x	2.7500 (2d)	=	85.0025	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.8900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	474.8353	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1053	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0100	(17)
Infiltration rate		0.3558	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2491	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3176	0.3113	0.3051	0.2740	0.2677	0.2366	0.2366	0.2304	0.2491	0.2677	0.2802	0.2926	(22b)
Effective ac	0.5504	0.5485	0.5465	0.5375	0.5358	0.5280	0.5280	0.5265	0.5310	0.5358	0.5393	0.5428	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.20)			37.3300	1.1450	42.7443			(27)
door			2.2200	1.2000	2.6640			(26)
RL			1.6200	1.1450	1.8550			(27a)
Heatloss Floor 1			80.2700	0.1300	10.4351	110.0000	8829.7000	(28a)
External Wall 1	127.5743	33.8800	93.6943	0.1800	16.8650	110.0000	10306.3730	(29a)
Wall in roof	45.7000		45.7000	0.1700	7.7690	9.0000	411.3000	(29a)
Dorma Wall	18.5900	5.6700	12.9200	0.1800	2.3256	9.0000	116.2800	(29a)
External Roof	26.8000		26.8000	0.1100	2.9480	9.0000	241.2000	(30)
Green Roof	27.6900		27.6900	0.1400	3.8766	9.0000	249.2100	(30)
Sloped Roof	25.7800	1.6200	24.1600	0.1400	3.3824	9.0000	217.4400	(30)
Total net area of external elements Aum(A, m2)			352.4043					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.8649			(33)
Party Wall 1			69.8200	0.0000	0.0000	70.0000	4887.4000	(32)
Internal Wall 1			276.5500			9.0000	2488.9500	(32c)
Internal Floor 1			30.9100			18.0000	556.3800	(32d)
Internal Floor 2			57.7100			18.0000	1038.7800	(32d)
Internal Ceiling 1			57.7100			9.0000	519.3900	(32e)
Internal Ceiling 2			30.9100			9.0000	278.1900	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 30140.5930 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 178.4629 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	23.5100	0.2360	5.5484
E3	Sill	17.7400	0.0220	0.3903
E4	Jamb	44.3000	0.0170	0.7531
E5	Ground floor (normal)	25.2000	0.0580	1.4616
E6	Intermediate floor within a dwelling	43.0300	0.0010	0.0430
E16	Corner (normal)	16.8600	0.0420	0.7081
E18	Party wall between dwellings	16.8600	0.0320	0.5395
R1	Head of roof window	1.6000	0.2400	0.3840
R2	Sill of roof window	1.6000	0.2400	0.3840
R3	Jamb of roof window	4.0600	0.2400	0.9744
E14	Flat roof	12.0500	0.0600	0.7230
P1	Party wall - Ground floor	11.9700	0.0430	0.5147
P4	Party wall - Roof (insulation at ceiling level)	3.8600	0.0400	0.1544
P2	Party wall - Intermediate floor within a dwelling	8.9700	0.0000	0.0000
E10	Eaves (insulation at ceiling level)	7.0000	0.0570	0.3990
E12	Gable (insulation at ceiling level)	4.9000	0.0430	0.2107
E13	Gable (insulation at rafter level)	7.7000	0.0430	0.3311
E11	Eaves (insulation at rafter level)	11.1000	0.0180	0.1998

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7191 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 108.5840 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	86.2483	85.9415	85.6408	84.2284	83.9641	82.7340	82.7340	82.5061	83.2078	83.9641	84.4987	85.0576	(38)

Heat transfer coeff

	194.8324	194.5256	194.2249	192.8124	192.5482	191.3180	191.3180	191.0902	191.7918	192.5482	193.0828	193.6417	(39)

Average = Sum(39)m / 12 = 192.8112

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1518	1.1500	1.1416	1.1401	1.1328	1.1328	1.1314	1.1356	1.1401	1.1432	1.1466	(40)
HLP (average)												1.1416	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9611 (42)
Hot water usage for mixer showers

101.5678	100.0415	97.8172	93.5616	90.4210	86.9187	84.9280	87.1354	89.5551	93.3155	97.6626	101.1787	(42a)

Hot water usage for baths

31.8887	31.4151	30.7482	29.5185	28.5977	27.5767	27.0253	27.6875	28.4086	29.5011	30.7561	31.7809	(42b)

Hot water usage for other uses

44.9545	43.3198	41.6851	40.0503	38.4156	36.7809	36.7809	38.4156	40.0503	41.6851	43.3198	44.9545	(42c)

Average daily hot water use (litres/day) 164.0756 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	178.4110	174.7763	170.2504	163.1304	157.4344	151.2764	148.7342	153.2385	158.0140	164.5016	171.7384	177.9140	(44)
Energy conte	282.5593	248.8791	261.6686	223.3174	211.9370	186.0120	179.8811	189.7413	194.8471	223.2272	244.6728	278.5703	(45)

Energy content (annual) Total = Sum(45)m = 2725.3133
Distribution loss (46)m = 0.15 x (45)m

42.3839	37.3319	39.2503	33.4976	31.7905	27.9018	26.9822	28.4612	29.2271	33.4841	36.7009	41.7855	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.0000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0800 (55)
Total storage loss

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)

If cylinder contains dedicated solar storage

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

339.3017	300.1303	318.4110	278.2294	268.6794	240.9240	236.6235	246.4837	249.7591	279.9696	299.5848	335.3127	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

339.3017	300.1303	318.4110	278.2294	268.6794	240.9240	236.6235	246.4837	249.7591	279.9696	299.5848	335.3127	(64)

Total per year (kWh/year) = Sum(64)m = 3393.4093 (64)
12Total per year (kWh/year) 3393 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

139.3449	123.7533	132.3987	118.1826	115.8630	105.7786	105.2044	108.4829	108.7163	119.6170	125.2833	138.0186	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

171.7007	190.0973	171.7007	177.4241	171.7007	177.4241	171.7007	171.7007	177.4241	171.7007	177.4241	171.7007	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

340.4159	343.9484	335.0467	316.0961	292.1744	269.6914	254.6713	251.1389	260.0405	278.9911	302.9128	325.3959	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	(71)

Water heating gains (Table 5)

187.2915	184.1566	177.9553	164.1426	155.7298	146.9147	141.4038	145.8104	150.9948	160.7755	174.0046	185.5088	(72)

Total internal gains

766.8245	785.6186	752.1190	725.0791	687.0212	661.4465	635.1921	636.0663	655.8757	678.8836	721.7578	750.0217	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.2600	11.2829	0.6300	0.7500	0.7700	41.6002	(75)
Southwest	20.0800	36.7938	0.6300	0.7500	0.7700	241.9211	(79)
Northwest	5.9900	11.2829	0.6300	0.7500	0.7700	22.1301	(81)
Northeast	1.6200	26.0000	0.6300	0.7500	1.0000	17.9115	(82)

Solar gains	323.5630	579.0071	863.6855	1185.7860	1430.7278	1464.6882	1393.7364	1204.7550	974.5253	659.4395	392.6889	273.5465	(83)
Total gains	1090.3875	1364.6256	1615.8046	1910.8650	2117.7491	2126.1347	2028.9285	1840.8212	1630.4011	1338.3231	1114.4467	1023.5682	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.9723	43.0400	43.1067	43.4224	43.4820	43.7616	43.7616	43.8138	43.6535	43.4820	43.3616	43.2365	
alpha	3.8648	3.8693	3.8738	3.8948	3.8988	3.9174	3.9174	3.9209	3.9102	3.8988	3.8908	3.8824	
util living area	0.9902	0.9769	0.9469	0.8666	0.7244	0.5458	0.4071	0.4634	0.7062	0.9200	0.9806	0.9923	(86)
Living	19.5839	19.8141	20.1291	20.5035	20.7626	20.8817	20.9114	20.9052	20.8149	20.4452	19.9403	19.5429	
Non living	18.2983	18.5911	18.9862	19.4427	19.7301	19.8479	19.8691	19.8672	19.7931	19.3872	18.7590	18.2504	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2756	19.8141	20.1291	20.5035	20.7626	20.8817	20.9114	20.9052	20.8149	20.4452	19.9403	19.7467	(87)
Th 2	19.9573	19.9588	19.9602	19.9670	19.9682	19.9741	19.9741	19.9752	19.9719	19.9682	19.9657	19.9630	(88)
util rest of house	0.9879	0.9715	0.9345	0.8371	0.6703	0.4687	0.3157	0.3663	0.6307	0.8951	0.9751	0.9904	(89)
MIT 2	19.2959	18.5911	18.9862	19.4427	19.7301	19.8479	19.8691	19.8672	19.7931	19.3872	18.7590	18.5590	(90)
Living area fraction										fLA = Living area / (4) =		0.3834	(91)
MIT	19.6715	19.0600	19.4244	19.8494	20.1260	20.2442	20.2687	20.2652	20.1848	19.7929	19.2119	19.0143	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6715	19.0600	19.4244	19.8494	20.1260	20.2442	20.2687	20.2652	20.1848	19.7929	19.2119	19.0143	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9656	0.9268	0.8333	0.6791	0.4897	0.3424	0.3945	0.6475	0.8901	0.9699	0.9882	(94)
Useful gains	1076.3171	1317.6210	1497.4945	1592.4028	1438.1677	1041.0635	694.6719	726.1332	1055.7570	1191.1806	1080.9315	1011.4437	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2994.8661	2754.4787	2510.2307	2111.1805	1622.4029	1079.8426	701.8881	738.5922	1167.0214	1770.0668	2338.5990	2868.6718	(97)
Space heating kWh	1427.4005	965.5683	753.4758	373.5199	137.0710	0.0000	0.0000	0.0000	0.0000	430.6913	905.5206	1381.7777	(98a)
Space heating requirement - total per year (kWh/year)												6375.0251	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1427.4005	965.5683	753.4758	373.5199	137.0710	0.0000	0.0000	0.0000	0.0000	430.6913	905.5206	1381.7777	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6375.0251	
Space heating per m2											(98c) / (4) =	37.7466	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	301.5869	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1427.4005	965.5683	753.4758	373.5199	137.0710	0.0000	0.0000	0.0000	0.0000	430.6913	905.5206	1381.7777	(98)
Space heating efficiency (main heating system 1)	301.5869	301.5869	301.5869	301.5869	301.5869	0.0000	0.0000	0.0000	0.0000	301.5869	301.5869	301.5869	(210)
Space heating fuel (main heating system)	473.2967	320.1626	249.8371	123.8515	45.4499	0.0000	0.0000	0.0000	0.0000	142.8084	300.2520	458.1691	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	339.3017	300.1303	318.4110	278.2294	268.6794	240.9240	236.6235	246.4837	249.7591	279.9696	299.5848	335.3127	(64)
Efficiency of water heater												173.5403	(216)
(217)m	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	(217)
Fuel for water heating, kWh/month	195.5175	172.9456	183.4795	160.3255	154.8224	138.8288	136.3507	142.0325	143.9199	161.3282	172.6312	193.2189	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	40.3626	32.3804	29.1550	21.3602	16.4992	13.4800	15.0511	19.5640	25.4117	33.3416	37.6592	41.4844	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2113.8273	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	173.5403	
Water heating fuel used	1955.4008	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	325.7494	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4394.9775	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2113.8273	0.1560	329.7502	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1955.4008	0.1410	275.7390	(264)
Space and water heating			605.4892	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	325.7494	0.1443	47.0157	(268)
Total CO2, kg/year			652.5049	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2113.8273	1.5775	3334.5414	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1955.4008	1.5214	2974.9951	(278)
Space and water heating			6309.5364	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	325.7494	1.5338	499.6454	(282)
Total Primary energy kWh/year			6809.1818	(286)
Dwelling Primary energy Rate (DPER)			40.3200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.2700 (1b)	x	2.7500 (2b)	=	220.7425	(1b) - (3b)
First floor	57.7100 (1c)	x	2.9300 (2c)	=	169.0903	(1c) - (3c)
Second floor	30.9100 (1d)	x	2.7500 (2d)	=	85.0025	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.8900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	474.8353	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0842	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3342	(18)
Number of sides sheltered		4	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2340 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2983	0.2925	0.2866	0.2574	0.2515	0.2223	0.2223	0.2164	0.2340	0.2515	0.2632	0.2749	(22b)
Effective ac	0.5445	0.5428	0.5411	0.5331	0.5316	0.5247	0.5247	0.5234	0.5274	0.5316	0.5346	0.5378	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.2200	1.0000	2.2200			(26)
TER Opening Type (Uw = 1.20)			37.3300	1.1450	42.7443			(27)
RL			1.6200	1.5918	2.5787			(27a)
Heatloss Floor 1			80.2700	0.1300	10.4351			(28a)
External Wall 1	127.5743	33.8800	93.6943	0.1800	16.8650			(29a)
Wall in roof	45.7000		45.7000	0.1800	8.2260			(29a)
Dorma Wall	18.5900	5.6700	12.9200	0.1800	2.3256			(29a)
External Roof	26.8000		26.8000	0.1100	2.9480			(30)
Green Roof	27.6900		27.6900	0.1100	3.0459			(30)
Sloped Roof	25.7800	1.6200	24.1600	0.1100	2.6576			(30)
Total net area of external elements Aum(A, m2)			352.4043					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.0461			(33)
Party Wall 1			69.8200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 178.4629 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	23.5100	0.0500	1.1755
E3	Sill	17.7400	0.0500	0.8870
E4	Jamb	44.3000	0.0500	2.2150
E5	Ground floor (normal)	25.2000	0.1600	4.0320
E6	Intermediate floor within a dwelling	43.0300	0.0000	0.0000
E16	Corner (normal)	16.8600	0.0900	1.5174
E18	Party wall between dwellings	16.8600	0.0600	1.0116
R1	Head of roof window	1.6000	0.0800	0.1280
R2	Sill of roof window	1.6000	0.0600	0.0960
R3	Jamb of roof window	4.0600	0.0800	0.3248
E14	Flat roof	12.0500	0.0800	0.9640
P1	Party wall - Ground floor	11.9700	0.0800	0.9576
P4	Party wall - Roof (insulation at ceiling level)	3.8600	0.1200	0.4632
P2	Party wall - Intermediate floor within a dwelling	8.9700	0.0000	0.0000
E10	Eaves (insulation at ceiling level)	7.0000	0.0600	0.4200
E12	Gable (insulation at ceiling level)	4.9000	0.0600	0.2940
E13	Gable (insulation at rafter level)	7.7000	0.0800	0.6160
E11	Eaves (insulation at rafter level)	11.1000	0.0400	0.4440

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.5461 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 109.5922 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	85.3199	85.0491	84.7838	83.5373	83.3041	82.2185	82.2185	82.0175	82.6367	83.3041	83.7759	84.2691	(38)
Heat transfer coeff	194.9121	194.6413	194.3760	193.1295	192.8963	191.8107	191.8107	191.6097	192.2289	192.8963	193.3681	193.8613	(39)
Average = Sum(39)m / 12 =												193.1284	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1541	1.1525	1.1509	1.1435	1.1421	1.1357	1.1357	1.1345	1.1382	1.1421	1.1449	1.1479	(40)
HLP (average)												1.1435	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9611 (42)
Hot water usage for mixer showers

73.8675	72.7574	71.1398	68.0448	65.7608	63.2136	61.7658	63.3712	65.1310	67.8658	71.0273	73.5845	(42a)

Hot water usage for baths

31.8887	31.4151	30.7482	29.5185	28.5977	27.5767	27.0253	27.6875	28.4086	29.5011	30.7561	31.7809	(42b)

Hot water usage for other uses

44.9545	43.3198	41.6851	40.0503	38.4156	36.7809	36.7809	38.4156	40.0503	41.6851	43.3198	44.9545	(42c)

Average daily hot water use (litres/day) 138.5369 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.7106	147.4923	143.5730	137.6136	132.7741	127.5713	125.5720	129.4743	133.5899	139.0520	145.1031	150.3198	(44)
Energy conte	238.6888	210.0270	220.6664	188.3862	178.7395	156.8638	151.8685	160.3163	164.7297	188.6922	206.7260	235.3645	(45)
Energy content (annual)										Total = Sum(45)m =		2301.0689	
Distribution loss (46)m = 0.15 x (45)m	35.8033	31.5041	33.1000	28.2579	26.8109	23.5296	22.7803	24.0474	24.7095	28.3038	31.0089	35.3047	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	289.6149	256.0248	271.5925	237.6695	229.6656	206.1471	202.7945	211.2424	214.0130	239.6183	256.0093	286.2906	(62)
WWHRS	-33.7691	-29.8657	-31.2736	-25.8958	-24.1340	-20.6516	-19.3576	-20.5849	-21.3669	-25.1893	-28.5364	-33.1438	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.8457	226.1590	240.3188	211.7737	205.5316	185.4955	183.4370	190.6575	192.6461	214.4290	227.4729	253.1468	(64)

												Total per year (kWh/year) = Sum(64)m =	2586.9136 (64)
12Total per year (kWh/year)													2587 (64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)
Heat gains from water heating, kWh/month													
120.1049	106.6322	114.1124	102.0650	100.1717	91.5838	91.2371	94.0460	94.1993	103.4810	108.1630	118.9996		(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	171.7007	190.0973	171.7007	177.4241	171.7007	177.4241	171.7007	171.7007	177.4241	171.7007	177.4241	171.7007	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	340.4159	343.9484	335.0467	316.0961	292.1744	269.6914	254.6713	251.1389	260.0405	278.9911	302.9128	325.3959	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	(71)
Water heating gains (Table 5)													
	161.4313	158.6788	153.3769	141.7570	134.6394	127.1998	122.6305	126.4059	130.8323	139.0874	150.2264	159.9456	(72)
Total internal gains													
	743.9643	763.1408	730.5407	705.6935	668.9309	641.7315	616.4189	616.6618	635.7132	660.1955	700.9797	727.4585	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.2600	11.2829	0.6300	0.7000	0.7700	38.8269	(75)
Southwest	20.0800	36.7938	0.6300	0.7000	0.7700	225.7930	(79)
Northwest	5.9900	11.2829	0.6300	0.7000	0.7700	20.6548	(81)
Northeast	1.6200	26.0000	0.6300	0.7000	1.0000	16.7174	(82)

Solar gains	301.9922	540.4066	806.1065	1106.7336	1335.3460	1367.0423	1300.8206	1124.4380	909.5570	615.4768	366.5097	255.3101	(83)
Total gains	1045.9564	1303.5473	1536.6472	1812.4271	2004.2768	2008.7739	1917.2395	1741.0998	1545.2702	1275.6724	1067.4893	982.7686	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.9547	43.0144	43.0732	43.3512	43.4036	43.6492	43.6492	43.6950	43.5543	43.4036	43.2977	43.1875	
alpha	3.8636	3.8676	3.8715	3.8901	3.8936	3.9099	3.9099	3.9130	3.9036	3.8936	3.8865	3.8792	
util living area													
	0.9915	0.9801	0.9542	0.8826	0.7494	0.5731	0.4301	0.4882	0.7313	0.9299	0.9832	0.9933	(86)
MIT	19.1824	19.4783	19.8910	20.3944	20.7601	20.9371	20.9840	20.9741	20.8385	20.3262	19.6545	19.1283	(87)
Th 2	19.9569	19.9582	19.9595	19.9654	19.9666	19.9718	19.9718	19.9727	19.9698	19.9666	19.9643	19.9619	(88)
util rest of house													
	0.9894	0.9753	0.9432	0.8554	0.6965	0.4938	0.3341	0.3869	0.6567	0.9073	0.9783	0.9916	(89)
MIT 2	17.8361	18.2125	18.7315	19.3469	19.7570	19.9313	19.9653	19.9612	19.8500	19.2818	18.4435	17.7704	(90)
Living area fraction									fLA = Living area / (4) =			0.3834	(91)
MIT	18.3523	18.6978	19.1761	19.7485	20.1416	20.3169	20.3558	20.3496	20.2290	19.6822	18.9078	18.2910	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3523	18.6978	19.1761	19.7485	20.1416	20.3169	20.3558	20.3496	20.2290	19.6822	18.9078	18.2910	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9676	0.9328	0.8488	0.7061	0.5214	0.3706	0.4251	0.6770	0.8997	0.9716	0.9878	(94)
Useful gains	1030.1314	1261.3227	1433.3324	1538.3855	1415.1701	1047.3477	710.5384	740.0782	1046.1726	1147.7516	1037.1448	970.7602	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2738.9611	2685.6179	2463.9215	2095.1602	1628.3486	1096.5634	720.4103	756.7753	1178.1640	1751.9296	2283.2468	2731.6949	(97)
Space heating kWh													
	1271.3693	957.1264	766.7583	400.8778	158.6048	0.0000	0.0000	0.0000	0.0000	449.5084	897.1934	1310.1354	(98a)
Space heating requirement - total per year (kWh/year)												6211.5737	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1271.3693	957.1264	766.7583	400.8778	158.6048	0.0000	0.0000	0.0000	0.0000	449.5084	897.1934	1310.1354	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6211.5737	
Space heating per m2											(98c) / (4) =	36.7788	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1271.3693	957.1264	766.7583	400.8778	158.6048	0.0000	0.0000	0.0000	0.0000	449.5084	897.1934	1310.1354	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													

	1377.4315	1036.9733	830.7240	434.3204	171.8362	0.0000	0.0000	0.0000	0.0000	487.0080	972.0405	1419.4316 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	255.8457	226.1590	240.3188	211.7737	205.5316	185.4955	183.4370	190.6575	192.6461	214.4290	227.4729	253.1468 (64)
Efficiency of water heater												79.8000 (216)
(217)m	87.1533	86.9262	86.4727	85.4680	83.4855	79.8000	79.8000	79.8000	79.8000	85.6792	86.8196	87.2073 (217)
Fuel for water heating, kWh/month												
	293.5581	260.1735	277.9128	247.7812	246.1885	232.4505	229.8709	238.9192	241.4111	250.2697	262.0066	290.2816 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	35.6760	28.6206	25.7697	18.8800	14.5834	11.9148	13.3035	17.2924	22.4611	29.4702	33.2865	36.6676 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-69.6390	-95.5160	-133.5731	-145.9004	-153.6861	-142.0019	-140.0477	-133.8354	-122.5586	-106.9542	-75.5230	-60.5067 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-47.8920	-99.6239	-196.0469	-291.7340	-383.2676	-384.3551	-380.0126	-323.0438	-238.3823	-141.7765	-63.6938	-37.9750 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	6729.7656 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	3070.8235 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	287.9260 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3967.5459 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	6206.9693 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6729.7656	0.2100	1413.2508	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3070.8235	0.2100	644.8729	(264)
Space and water heating			2058.1237	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	287.9260	0.1443	41.5566	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1379.7423	0.1352	-186.5603	
PV Unit electricity exported	-2587.8036	0.1262	-326.4788	
Total			-513.0391	(269)
Total CO2, kg/year			1598.5705	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	6729.7656	1.1300	7604.6352	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3070.8235	1.1300	3470.0306	(278)
Space and water heating			11074.6658	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	287.9260	1.5338	441.6304	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1379.7423	1.4998	-2069.2859	
PV Unit electricity exported	-2587.8036	0.4631	-1198.4305	
Total			-3267.7164	(283)
Total Primary energy kWh/year			8378.6806	(286)
Target Primary Energy Rate (TPER)			49.6100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)			Volume (m3)	
Ground floor	80.2700	(1b)	x	2.7500	(2b)	= 220.7425	(1b) - (3b)
First floor	57.7100	(1c)	x	2.9300	(2c)	= 169.0903	(1c) - (3c)
Second floor	30.9100	(1d)	x	2.7500	(2d)	= 85.0025	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.8900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 474.8353	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0842 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0100 (17)
Infiltration rate		0.3347 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2343 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2988	0.2929	0.2870	0.2577	0.2519	0.2226	0.2226	0.2167	0.2343	0.2519	0.2636	0.2753	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5446	0.5429	0.5412	0.5332	0.5317	0.5248	0.5248	0.5235	0.5275	0.5317	0.5347	0.5379	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.20)			37.3300	1.1450	42.7443			(27)
door			2.2200	1.2000	2.6640			(26)
RL			1.6200	1.1450	1.8550			(27a)
Heatloss Floor 1			80.2700	0.1300	10.4351	110.0000	8829.7000	(28a)
External Wall 1	127.5743	33.8800	93.6943	0.1800	16.8650	110.0000	10306.3730	(29a)
Wall in roof	45.7000		45.7000	0.1700	7.7690	9.0000	411.3000	(29a)
Dorma Wall	18.5900	5.6700	12.9200	0.1800	2.3256	9.0000	116.2800	(29a)
External Roof	26.8000		26.8000	0.1100	2.9480	9.0000	241.2000	(30)
Green Roof	27.6900		27.6900	0.1400	3.8766	9.0000	249.2100	(30)
Sloped Roof	25.7800	1.6200	24.1600	0.1400	3.3824	9.0000	217.4400	(30)
Total net area of external elements Aum(A, m2)			352.4043					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.8649			(33)
Party Wall 1			69.8200	0.0000	0.0000	70.0000	4887.4000	(32)
Internal Wall 1			276.5500			9.0000	2488.9500	(32c)
Internal Floor 1			30.9100			18.0000	556.3800	(32d)
Internal Floor 2			57.7100			18.0000	1038.7800	(32d)
Internal Ceiling 1			57.7100			9.0000	519.3900	(32e)
Internal Ceiling 2			30.9100			9.0000	278.1900	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 30140.5930 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	178.4629 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.5100	0.2360	5.5484
E3 Sill	17.7400	0.0220	0.3903
E4 Jamb	44.3000	0.0170	0.7531
E5 Ground floor (normal)	25.2000	0.0580	1.4616
E6 Intermediate floor within a dwelling	43.0300	0.0010	0.0430
E16 Corner (normal)	16.8600	0.0420	0.7081
E18 Party wall between dwellings	16.8600	0.0320	0.5395
R1 Head of roof window	1.6000	0.2400	0.3840
R2 Sill of roof window	1.6000	0.2400	0.3840
R3 Jamb of roof window	4.0600	0.2400	0.9744
E14 Flat roof	12.0500	0.0600	0.7230
P1 Party wall - Ground floor	11.9700	0.0430	0.5147
P4 Party wall - Roof (insulation at ceiling level)	3.8600	0.0400	0.1544
P2 Party wall - Intermediate floor within a dwelling	8.9700	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	7.0000	0.0570	0.3990
E12 Gable (insulation at ceiling level)	4.9000	0.0430	0.2107
E13 Gable (insulation at rafter level)	7.7000	0.0430	0.3311
E11 Eaves (insulation at rafter level)	11.1000	0.0180	0.1998

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7191 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 108.5840 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	85.3407	85.0692	84.8030	83.5529	83.3189	82.2301	82.2301	82.0284	82.6495	83.3189	83.7921	84.2868	(38)
Heat transfer coeff	193.9248	193.6532	193.3871	192.1369	191.9030	190.8141	190.8141	190.6125	191.2335	191.9030	192.3762	192.8709	(39)

Average = Sum(39)m / 12 =	192.1358

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

HLP	1.1482	1.1466	1.1450	1.1376	1.1363	1.1298	1.1298	1.1286	1.1323	1.1363	1.1391	1.1420	(40)
HLP (average)												1.1376	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9611 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.8887	31.4151	30.7482	29.5185	28.5977	27.5767	27.0253	27.6875	28.4086	29.5011	30.7561	31.7809	(42b)

Hot water usage for other uses

44.9545	43.3198	41.6851	40.0503	38.4156	36.7809	36.7809	38.4156	40.0503	41.6851	43.3198	44.9545	(42c)

Average daily hot water use (litres/day) 70.4335 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.8431	74.7348	72.4332	69.5688	67.0134	64.3577	63.8062	66.1031	68.4589	71.1861	74.0758	76.7353	(44)
Energy conte	121.7007	106.4214	111.3271	95.2363	90.2129	79.1353	77.1680	81.8495	84.4167	96.5989	105.5346	120.1490	(45)
Energy content (annual)											Total = Sum(45)m =	1169.7504	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.4456	90.4582	94.6281	80.9508	76.6809	67.2650	65.5928	69.5721	71.7542	82.1091	89.7044	102.1266	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.4456	90.4582	94.6281	80.9508	76.6809	67.2650	65.5928	69.5721	71.7542	82.1091	89.7044	102.1266	(64)
										Total per year (kWh/year) = Sum(64)m =		994.2878	(64)
12Total per year (kWh/year)												994	(64)
Electric shower(s)													
	59.1556	52.7081	57.5552	54.9242	55.9549	53.3755	55.1547	55.9549	54.9242	57.5552	56.4730	59.1556	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		672.8911	(64a)
Heat gains from water heating, kWh/month													
	40.6503	35.7916	38.0458	33.9688	33.1590	30.1601	30.1869	31.3817	31.6696	34.9161	36.5443	40.3205	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	171.7007	190.0973	171.7007	177.4241	171.7007	177.4241	171.7007	171.7007	177.4241	171.7007	177.4241	171.7007	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	340.4159	343.9484	335.0467	316.0961	292.1744	269.6914	254.6713	251.1389	260.0405	278.9911	302.9128	325.3959	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	(71)
Water heating gains (Table 5)													
	54.6375	53.2613	51.1369	47.1788	44.5685	41.8891	40.5738	42.1798	43.9856	46.9302	50.7560	54.1943	(72)
Total internal gains													
	634.1705	654.7232	625.3006	608.1154	575.8599	556.4208	534.3621	532.4356	548.8665	565.0383	598.5092	618.7072	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.2600	11.2829	0.6300	0.7500	0.7700	41.6002	(75)
Southwest	20.0800	36.7938	0.6300	0.7500	0.7700	241.9211	(79)
Northwest	5.9900	11.2829	0.6300	0.7500	0.7700	22.1301	(81)
Northeast	1.6200	26.0000	0.6300	0.7500	1.0000	17.9115	(82)

Solar gains	323.5630	579.0071	863.6855	1185.7860	1430.7278	1464.6882	1393.7364	1204.7550	974.5253	659.4395	392.6889	273.5465	(83)
Total gains	957.7335	1233.7303	1488.9861	1793.9013	2006.5878	2021.1090	1928.0985	1737.1906	1523.3918	1224.4778	991.1982	892.2537	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.1734	43.2339	43.2934	43.5751	43.6282	43.8772	43.8772	43.9236	43.7810	43.6282	43.5209	43.4093	
alpha	3.8782	3.8823	3.8862	3.9050	3.9085	3.9251	3.9251	3.9282	3.9187	3.9085	3.9014	3.8940	
util living area													
	0.9937	0.9833	0.9580	0.8847	0.7472	0.5681	0.4259	0.4871	0.7359	0.9370	0.9868	0.9952	(86)
MIT	19.1234	19.4364	19.8687	20.3930	20.7651	20.9398	20.9848	20.9747	20.8365	20.3018	19.6053	19.0669	(87)
Th 2	19.9616	19.9629	19.9642	19.9702	19.9713	19.9766	19.9766	19.9775	19.9745	19.9713	19.9691	19.9667	(88)
util rest of house													
	0.9922	0.9793	0.9478	0.8578	0.6943	0.4895	0.3311	0.3864	0.6618	0.9163	0.9829	0.9940	(89)
MIT 2	18.2491	18.5601	18.9849	19.4863	19.8116	19.9464	19.9718	19.9688	19.8797	19.4147	18.7343	18.1965	(90)
Living area fraction										fLA = Living area / (4) =		0.3834	(91)
MIT	18.5843	18.8961	19.3237	19.8339	20.1772	20.3273	20.3601	20.3544	20.2465	19.7548	19.0682	18.5302	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5843	18.8961	19.3237	19.8339	20.1772	20.3273	20.3601	20.3544	20.2465	19.7548	19.0682	18.5302	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9738	0.9400	0.8538	0.7056	0.5174	0.3673	0.4245	0.6831	0.9110	0.9784	0.9917	(94)
Useful gains	947.4859	1201.3796	1399.6573	1531.5494	1415.9006	1045.6331	708.1140	737.4405	1040.5729	1115.4434	969.7844	884.8259	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2770.0768	2710.3824	2479.9382	2100.8144	1626.7942	1092.8447	717.4879	753.7656	1175.4217	1756.8298	2302.4044	2763.8733	(97)
Space heating kWh	1356.0076	1014.0498	803.7290	409.8708	156.9048	0.0000	0.0000	0.0000	0.0000	477.1915	959.4864	1398.0113	(98a)
Space heating requirement - total per year (kWh/year)												6575.2513	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1356.0076	1014.0498	803.7290	409.8708	156.9048	0.0000	0.0000	0.0000	0.0000	477.1915	959.4864	1398.0113	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6575.2513	
Space heating per m2											(98c) / (4) =	38.9322	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1793.6527	1412.0245	1448.6548	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8778	0.9254	0.8950	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1574.5357	1306.7409	1296.5406	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2263.0974	2158.9227	1942.9582	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	495.7644	634.0233	480.9347	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	123.9411	158.5058	120.2337	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												402.6806	(107)
Energy for space heating												38.9322	(99)
Energy for space cooling												2.3843	(108)
Total												41.3164	(109)
Fabric Energy Efficiency (DFEE)												41.3	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.2700	(1b)	x 2.7500	(2b) =	220.7425	(1b) - (3b)
First floor	57.7100	(1c)	x 2.9300	(2c) =	169.0903	(1c) - (3c)
Second floor	30.9100	(1d)	x 2.7500	(2d) =	85.0025	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.8900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		474.8353	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0842 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3342 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2340 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2983	0.2925	0.2866	0.2574	0.2515	0.2223	0.2223	0.2164	0.2340	0.2515	0.2632	0.2749	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)

Effective ac	0.5445	0.5428	0.5411	0.5331	0.5316	0.5247	0.5247	0.5234	0.5274	0.5316	0.5346	0.5378 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.2200	1.0000	2.2200			(26)
TER Opening Type (Uw = 1.20)			37.3300	1.1450	42.7443			(27)
RL			1.6200	1.5918	2.5787			(27a)
Heatloss Floor 1			80.2700	0.1300	10.4351			(28a)
External Wall 1	127.5743	33.8800	93.6943	0.1800	16.8650			(29a)
Wall in roof	45.7000		45.7000	0.1800	8.2260			(29a)
Dorma Wall	18.5900	5.6700	12.9200	0.1800	2.3256			(29a)
External Roof	26.8000		26.8000	0.1100	2.9480			(30)
Green Roof	27.6900		27.6900	0.1100	3.0459			(30)
Sloped Roof	25.7800	1.6200	24.1600	0.1100	2.6576			(30)
Total net area of external elements Aum(A, m2)			352.4043					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.0461			(33)
Party Wall 1			69.8200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 178.4629 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.5100	0.0500	1.1755
E3 Sill	17.7400	0.0500	0.8870
E4 Jamb	44.3000	0.0500	2.2150
E5 Ground floor (normal)	25.2000	0.1600	4.0320
E6 Intermediate floor within a dwelling	43.0300	0.0000	0.0000
E16 Corner (normal)	16.8600	0.0900	1.5174
E18 Party wall between dwellings	16.8600	0.0600	1.0116
R1 Head of roof window	1.6000	0.0800	0.1280
R2 Sill of roof window	1.6000	0.0600	0.0960
R3 Jamb of roof window	4.0600	0.0800	0.3248
E14 Flat roof	12.0500	0.0800	0.9640
P1 Party wall - Ground floor	11.9700	0.0800	0.9576
P4 Party wall - Roof (insulation at ceiling level)	3.8600	0.1200	0.4632
P2 Party wall - Intermediate floor within a dwelling	8.9700	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	7.0000	0.0600	0.4200
E12 Gable (insulation at ceiling level)	4.9000	0.0600	0.2940
E13 Gable (insulation at rafter level)	7.7000	0.0800	0.6160
E11 Eaves (insulation at rafter level)	11.1000	0.0400	0.4440

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.5461 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 109.5922 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	85.3199	85.0491	84.7838	83.5373	83.3041	82.2185	82.2185	82.0175	82.6367	83.3041	83.7759	84.2691	(38)
Heat transfer coeff	194.9121	194.6413	194.3760	193.1295	192.8963	191.8107	191.8107	191.6097	192.2289	192.8963	193.3681	193.8613	(39)
Average = Sum(39)m / 12 =												193.1284	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1541	1.1525	1.1509	1.1435	1.1421	1.1357	1.1357	1.1345	1.1382	1.1421	1.1449	1.1479	(40)
HLP (average)												1.1435	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9611 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.8887	31.4151	30.7482	29.5185	28.5977	27.5767	27.0253	27.6875	28.4086	29.5011	30.7561	31.7809	(42b)

Hot water usage for other uses

44.9545	43.3198	41.6851	40.0503	38.4156	36.7809	36.7809	38.4156	40.0503	41.6851	43.3198	44.9545	(42c)

Average daily hot water use (litres/day) 70.4335 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.8431	74.7348	72.4332	69.5688	67.0134	64.3577	63.8062	66.1031	68.4589	71.1861	74.0758	76.7353	(44)
Energy conte	121.7007	106.4214	111.3271	95.2363	90.2129	79.1353	77.1680	81.8495	84.4167	96.5989	105.5346	120.1490	(45)
Energy content (annual)										Total = Sum(45)m =		1169.7504	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.4456	90.4582	94.6281	80.9508	76.6809	67.2650	65.5928	69.5721	71.7542	82.1091	89.7044	102.1266	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.4456	90.4582	94.6281	80.9508	76.6809	67.2650	65.5928	69.5721	71.7542	82.1091	89.7044	102.1266	(64)
										Total per year (kWh/year) = Sum(64)m =		994.2878	(64)
12Total per year (kWh/year)												994	(64)
Electric shower(s)													
	59.1556	52.7081	57.5552	54.9242	55.9549	53.3755	55.1547	55.9549	54.9242	57.5552	56.4730	59.1556	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		672.8911	(64a)
Heat gains from water heating, kWh/month													
	40.6503	35.7916	38.0458	33.9688	33.1590	30.1601	30.1869	31.3817	31.6696	34.9161	36.5443	40.3205	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	148.0542	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	171.7007	190.0973	171.7007	177.4241	171.7007	177.4241	171.7007	171.7007	177.4241	171.7007	177.4241	171.7007	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	340.4159	343.9484	335.0467	316.0961	292.1744	269.6914	254.6713	251.1389	260.0405	278.9911	302.9128	325.3959	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	37.8054	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	(71)
Water heating gains (Table 5)													
	54.6375	53.2613	51.1369	47.1788	44.5685	41.8891	40.5738	42.1798	43.9856	46.9302	50.7560	54.1943	(72)
Total internal gains													
	634.1705	654.7232	625.3006	608.1154	575.8599	556.4208	534.3621	532.4356	548.8665	565.0383	598.5092	618.7072	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.2600	11.2829	0.6300	0.7000	0.7700	38.8269	(75)
Southwest	20.0800	36.7938	0.6300	0.7000	0.7700	225.7930	(79)
Northwest	5.9900	11.2829	0.6300	0.7000	0.7700	20.6548	(81)
Northeast	1.6200	26.0000	0.6300	0.7000	1.0000	16.7174	(82)

Solar gains	301.9922	540.4066	806.1065	1106.7336	1335.3460	1367.0423	1300.8206	1124.4380	909.5570	615.4768	366.5097	255.3101	(83)
Total gains	936.1626	1195.1298	1431.4071	1714.8489	1911.2059	1923.4632	1835.1827	1656.8736	1458.4235	1180.5152	965.0189	874.0173	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.9547	43.0144	43.0732	43.3512	43.4036	43.6492	43.6492	43.6950	43.5543	43.4036	43.2977	43.1875	
alpha	3.8636	3.8676	3.8715	3.8901	3.8936	3.9099	3.9099	3.9130	3.9036	3.8936	3.8865	3.8792	
util living area													
	0.9942	0.9850	0.9629	0.8976	0.7697	0.5934	0.4477	0.5099	0.7567	0.9436	0.9880	0.9955	(86)
MIT	19.0953	19.3961	19.8190	20.3447	20.7347	20.9290	20.9816	20.9699	20.8167	20.2668	19.5756	19.0412	(87)
Th 2	19.9569	19.9582	19.9595	19.9654	19.9666	19.9718	19.9718	19.9727	19.9698	19.9666	19.9643	19.9619	(88)
util rest of house													
	0.9928	0.9813	0.9537	0.8727	0.7182	0.5130	0.3485	0.4054	0.6838	0.9245	0.9844	0.9944	(89)
MIT 2	18.2177	18.5169	18.9335	19.4392	19.7841	19.9358	19.9659	19.9622	19.8620	19.3787	18.7016	18.1675	(90)
Living area fraction									fLA = Living area / (4) =			0.3834	(91)
MIT	18.5542	18.8540	19.2730	19.7864	20.1486	20.3166	20.3553	20.3485	20.2280	19.7192	19.0367	18.5025	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5542	18.8540	19.2730	19.7864	20.1486	20.3166	20.3553	20.3485	20.2280	19.7192	19.0367	18.5025	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9762	0.9461	0.8677	0.7280	0.5410	0.3863	0.4448	0.7037	0.9189	0.9801	0.9922	(94)
Useful gains	926.8346	1166.6351	1354.2507	1488.0258	1391.3139	1040.5904	708.8937	737.0277	1026.3611	1084.7381	945.8050	867.1989	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2778.3061	2716.0163	2482.7561	2102.4834	1629.6962	1096.5026	720.3072	756.5781	1177.9834	1759.0511	2308.1707	2772.7004	(97)
Space heating kWh													
	1377.4948	1041.1842	839.6080	442.4095	177.3564	0.0000	0.0000	0.0000	0.0000	501.6888	980.9033	1417.6931	(98a)
Space heating requirement - total per year (kWh/year)												6778.3381	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1377.4948	1041.1842	839.6080	442.4095	177.3564	0.0000	0.0000	0.0000	0.0000	501.6888	980.9033	1417.6931	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6778.3381	
Space heating per m2											(98c) / (4) =	40.1346	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1803.0206	1419.3992	1456.2334	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8599	0.9127	0.8794	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1550.4511	1295.5371	1280.5809	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2150.5167	2051.7854	1850.2985	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	432.0472	562.6487	423.8699	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	108.0118	140.6622	105.9675	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												354.6415	(107)
Energy for space heating												40.1346	(99)
Energy for space cooling												2.0998	(108)
Total												42.2345	(109)
Fabric Energy Efficiency (TFEE)												42.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.2700	(1b)	x 2.7500	(2b)	= 220.7425	(1b) - (3b)
First floor	57.7100	(1c)	x 2.9300	(2c)	= 169.0903	(1c) - (3c)
Second floor	30.9100	(1d)	x 2.7500	(2d)	= 85.0025	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.8900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 474.8353	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1053 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0100 (17)
Infiltration rate		0.3558 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2491 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3176	0.3113	0.3051	0.2740	0.2677	0.2366	0.2366	0.2304	0.2491	0.2677	0.2802	0.2926	(22b)
Effective ac	0.5504	0.5485	0.5465	0.5375	0.5358	0.5280	0.5280	0.5265	0.5310	0.5358	0.5393	0.5428	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.20)			37.3300	1.1450	42.7443			(27)
door			2.2200	1.2000	2.6640			(26)
RL			1.6200	1.1450	1.8550			(27a)
Heatloss Floor 1			80.2700	0.1300	10.4351	110.0000	8829.7000	(28a)
External Wall 1	127.5743	33.8800	93.6943	0.1800	16.8650	110.0000	10306.3730	(29a)
Wall in roof	45.7000		45.7000	0.1700	7.7690	9.0000	411.3000	(29a)
Dorma Wall	18.5900	5.6700	12.9200	0.1800	2.3256	9.0000	116.2800	(29a)
External Roof	26.8000		26.8000	0.1100	2.9480	9.0000	241.2000	(30)
Green Roof	27.6900		27.6900	0.1400	3.8766	9.0000	249.2100	(30)
Sloped Roof	25.7800	1.6200	24.1600	0.1400	3.3824	9.0000	217.4400	(30)
Total net area of external elements Aum(A, m2)			352.4043					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.8649			(33)
Party Wall 1			69.8200	0.0000	0.0000	70.0000	4887.4000	(32)
Internal Wall 1			276.5500			9.0000	2488.9500	(32c)
Internal Floor 1			30.9100			18.0000	556.3800	(32d)
Internal Floor 2			57.7100			18.0000	1038.7800	(32d)
Internal Ceiling 1			57.7100			9.0000	519.3900	(32e)
Internal Ceiling 2			30.9100			9.0000	278.1900	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	30140.5930 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		178.4629 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	23.5100	0.2360	5.5484
E3	Sill	17.7400	0.0220	0.3903
E4	Jamb	44.3000	0.0170	0.7531
E5	Ground floor (normal)	25.2000	0.0580	1.4616
E6	Intermediate floor within a dwelling	43.0300	0.0010	0.0430
E16	Corner (normal)	16.8600	0.0420	0.7081
E18	Party wall between dwellings	16.8600	0.0320	0.5395
R1	Head of roof window	1.6000	0.2400	0.3840
R2	Sill of roof window	1.6000	0.2400	0.3840
R3	Jamb of roof window	4.0600	0.2400	0.9744
E14	Flat roof	12.0500	0.0600	0.7230
P1	Party wall - Ground floor	11.9700	0.0430	0.5147
P4	Party wall - Roof (insulation at ceiling level)	3.8600	0.0400	0.1544
P2	Party wall - Intermediate floor within a dwelling	8.9700	0.0000	0.0000
E10	Eaves (insulation at ceiling level)	7.0000	0.0570	0.3990
E12	Gable (insulation at ceiling level)	4.9000	0.0430	0.2107
E13	Gable (insulation at rafter level)	7.7000	0.0430	0.3311
E11	Eaves (insulation at rafter level)	11.1000	0.0180	0.1998

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.7191 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	108.5840 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(38)m	86.2483	85.9415	85.6408	84.2284	83.9641	82.7340	82.7340	82.5061	83.2078	83.9641	84.4987	85.0576	(38)
Heat transfer coeff													
	194.8324	194.5256	194.2249	192.8124	192.5482	191.3180	191.3180	191.0902	191.7918	192.5482	193.0828	193.6417	(39)
Average = Sum(39)m / 12 =												192.8112	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1518	1.1500	1.1416	1.1401	1.1328	1.1328	1.1314	1.1356	1.1401	1.1432	1.1466	(40)
HLP (average)												1.1416	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9611	(42)
Hot water usage for mixer showers													
	101.5678	100.0415	97.8172	93.5616	90.4210	86.9187	84.9280	87.1354	89.5551	93.3155	97.6626	101.1787	(42a)
Hot water usage for baths													
	31.8887	31.4151	30.7482	29.5185	28.5977	27.5767	27.0253	27.6875	28.4086	29.5011	30.7561	31.7809	(42b)
Hot water usage for other uses													
	44.9545	43.3198	41.6851	40.0503	38.4156	36.7809	36.7809	38.4156	40.0503	41.6851	43.3198	44.9545	(42c)
Average daily hot water use (litres/day)												164.0756	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	178.4110	174.7763	170.2504	163.1304	157.4344	151.2764	148.7342	153.2385	158.0140	164.5016	171.7384	177.9140	(44)
Energy conte	282.5593	248.8791	261.6686	223.3174	211.9370	186.0120	179.8811	189.7413	194.8471	223.2272	244.6728	278.5703	(45)
Energy content (annual)										Total = Sum(45)m =		2725.3133	
Distribution loss (46)m = 0.15 x (45)m													
	42.3839	37.3319	39.2503	33.4976	31.7905	27.9018	26.9822	28.4612	29.2271	33.4841	36.7009	41.7855	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0800	(55)
Total storage loss													
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage													
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	339.3017	300.1303	318.4110	278.2294	268.6794	240.9240	236.6235	246.4837	249.7591	279.9696	299.5848	335.3127	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	339.3017	300.1303	318.4110	278.2294	268.6794	240.9240	236.6235	246.4837	249.7591	279.9696	299.5848	335.3127	(64)
										Total per year (kWh/year) = Sum(64)m =		3393.4093	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	139.3449	123.7533	132.3987	118.1826	115.8630	105.7786	105.2044	108.4829	108.7163	119.6170	125.2833	138.0186	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.1132	40.9573	33.3087	25.2169	18.8499	15.9139	17.1955	22.3514	30.0000	38.0919	44.4588	47.3948	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	508.0835	513.3558	500.0697	471.7853	436.0812	402.5244	380.1064	374.8341	388.1202	416.4047	452.1087	485.6655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	(71)
Water heating gains (Table 5)													
	187.2915	184.1566	177.9553	164.1426	155.7298	146.9147	141.4038	145.8104	150.9948	160.7755	174.0046	185.5088	(72)
Total internal gains													
	856.4375	853.4191	826.2831	776.0940	725.6102	680.3023	653.6550	657.9452	684.0643	730.2213	785.5214	833.5184	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.2600	11.2829	0.6300	0.7500	0.7700	41.6002	(75)
Southwest	20.0800	36.7938	0.6300	0.7500	0.7700	241.9211	(79)
Northwest	5.9900	11.2829	0.6300	0.7500	0.7700	22.1301	(81)
Northeast	1.6200	26.0000	0.6300	0.7500	1.0000	17.9115	(82)

Solar gains	323.5630	579.0071	863.6855	1185.7860	1430.7278	1464.6882	1393.7364	1204.7550	974.5253	659.4395	392.6889	273.5465	(83)
Total gains	1180.0005	1432.4261	1689.9686	1961.8799	2156.3380	2144.9905	2047.3914	1862.7001	1658.5896	1389.6607	1178.2103	1107.0649	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.9723	43.0400	43.1067	43.4224	43.4820	43.7616	43.7616	43.8138	43.6535	43.4820	43.3616	43.2365	
alpha	3.8648	3.8693	3.8738	3.8948	3.8988	3.9174	3.9174	3.9209	3.9102	3.8988	3.8908	3.8824	
util living area													
	0.9873	0.9731	0.9397	0.8583	0.7162	0.5417	0.4036	0.4585	0.6983	0.9116	0.9768	0.9899	(86)

Living	19.6363	19.8515	20.1647	20.5206	20.7690	20.8827	20.9117	20.9058	20.8192	20.4672	19.9761	19.5923	
Non living	18.3648	18.6378	19.0295	19.4619	19.7361	19.8486	19.8692	19.8675	19.7965	19.4124	18.8037	18.3131	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3024	19.8515	20.1647	20.5206	20.7690	20.8827	20.9117	20.9058	20.8192	20.4672	19.9761	19.7892	(87)
Th 2	19.9573	19.9588	19.9602	19.9670	19.9682	19.9741	19.9741	19.9752	19.9719	19.9682	19.9657	19.9630	(88)
util rest of house													
	0.9842	0.9669	0.9259	0.8277	0.6618	0.4649	0.3129	0.3622	0.6226	0.8849	0.9704	0.9875	(89)
MIT 2	19.3224	18.6378	19.0295	19.4619	19.7361	19.8486	19.8692	19.8675	19.7965	19.4124	18.8037	18.6105	(90)
Living area fraction										fLA = Living area / (4) =		0.3834	(91)
MIT	19.6981	19.1031	19.4647	19.8678	20.1321	20.2450	20.2689	20.2655	20.1886	19.8168	19.2532	19.0624	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6981	19.1031	19.4647	19.8678	20.1321	20.2450	20.2689	20.2655	20.1886	19.8168	19.2532	19.0624	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9833	0.9605	0.9181	0.8244	0.6710	0.4859	0.3394	0.3901	0.6397	0.8802	0.9647	0.9848	(94)
Useful gains	1160.3535	1375.8115	1551.5759	1617.4130	1446.9146	1042.2340	694.9259	726.6814	1061.0608	1223.2473	1136.5802	1090.2180	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	3000.0506	2762.8748	2518.0716	2114.7297	1623.5888	1079.9971	701.9236	738.6676	1167.7377	1774.6703	2346.5714	2877.9720	(97)
Space heating kWh													
	1368.7346	932.1065	719.0727	358.0681	131.4456	0.0000	0.0000	0.0000	0.0000	410.2587	871.1937	1330.0890	(98a)
Space heating requirement - total per year (kWh/year)												6120.9690	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1368.7346	932.1065	719.0727	358.0681	131.4456	0.0000	0.0000	0.0000	0.0000	410.2587	871.1937	1330.0890	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6120.9690	
Space heating per m2											(98c) / (4) =	36.2423	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	301.5869 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1368.7346	932.1065	719.0727	358.0681	131.4456	0.0000	0.0000	0.0000	0.0000	410.2587	871.1937	1330.0890	(98)
Space heating efficiency (main heating system 1)													
	301.5869	301.5869	301.5869	301.5869	301.5869	0.0000	0.0000	0.0000	0.0000	301.5869	301.5869	301.5869	(210)
Space heating fuel (main heating system)													
	453.8443	309.0674	238.4297	118.7280	43.5847	0.0000	0.0000	0.0000	0.0000	136.0334	288.8699	441.0302	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	339.3017	300.1303	318.4110	278.2294	268.6794	240.9240	236.6235	246.4837	249.7591	279.9696	299.5848	335.3127	(64)
Efficiency of water heater												173.5403	(216)
(217)m	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	(217)
Fuel for water heating, kWh/month													
	195.5175	172.9456	183.4795	160.3255	154.8224	138.8288	136.3507	142.0325	143.9199	161.3282	172.6312	193.2189	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	40.3626	32.3804	29.1550	21.3602	16.4992	13.4800	15.0511	19.5640	25.4117	33.3416	37.6592	41.4844	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2029.5875 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	173.5403
Water heating fuel used	1955.4008 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	325.7494 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4310.7377 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2029.5875	16.4900	334.6790	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1955.4008	16.4900	322.4456	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	325.7494	16.4900	53.7161	(250)
Additional standing charges			0.0000	(251)
Total energy cost			710.8406	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1964	(257)
SAP value		80.6060	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2029.5875	0.1560	316.6462	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1955.4008	0.1410	275.7390	(264)
Space and water heating			592.3852	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	325.7494	0.1443	47.0157	(268)
Total CO2, kg/year			639.4009	(272)
CO2 emissions per m2			3.7900	(273)
EI value			95.9942	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.2700 (1b)	x	2.7500 (2b)	=	220.7425	(1b) - (3b)
First floor	57.7100 (1c)	x	2.9300 (2c)	=	169.0903	(1c) - (3c)
Second floor	30.9100 (1d)	x	2.7500 (2d)	=	85.0025	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.8900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		474.8353	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1053 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0100 (17)
Infiltration rate		0.3558 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2491 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.2000	4.1000	3.9000	3.9000	3.4000	3.6000	3.4000	3.4000	3.7000	3.6000	4.0000	(22)
Wind factor	1.0750	1.0500	1.0250	0.9750	0.9750	0.8500	0.9000	0.8500	0.8500	0.9250	0.9000	1.0000	(22a)
Adj infilt rate	0.2677	0.2615	0.2553	0.2428	0.2428	0.2117	0.2242	0.2117	0.2117	0.2304	0.2242	0.2491	(22b)
Effective ac	0.5358	0.5342	0.5326	0.5295	0.5295	0.5224	0.5251	0.5224	0.5224	0.5265	0.5251	0.5310	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.20)			37.3300	1.1450	42.7443			(27)
door			2.2200	1.2000	2.6640			(26)
RL			1.6200	1.1450	1.8550			(27a)
Heatloss Floor 1			80.2700	0.1300	10.4351	110.0000	8829.7000	(28a)
External Wall 1	127.5743	33.8800	93.6943	0.1800	16.8650	110.0000	10306.3730	(29a)
Wall in roof	45.7000		45.7000	0.1700	7.7690	9.0000	411.3000	(29a)
Dorma Wall	18.5900	5.6700	12.9200	0.1800	2.3256	9.0000	116.2800	(29a)
External Roof	26.8000		26.8000	0.1100	2.9480	9.0000	241.2000	(30)
Green Roof	27.6900		27.6900	0.1400	3.8766	9.0000	249.2100	(30)
Sloped Roof	25.7800	1.6200	24.1600	0.1400	3.3824	9.0000	217.4400	(30)
Total net area of external elements Aum(A, m2)			352.4043					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.8649			(33)
Party Wall 1			69.8200	0.0000	0.0000	70.0000	4887.4000	(32)
Internal Wall 1			276.5500			9.0000	2488.9500	(32c)
Internal Floor 1			30.9100			18.0000	556.3800	(32d)
Internal Floor 2			57.7100			18.0000	1038.7800	(32d)
Internal Ceiling 1			57.7100			9.0000	519.3900	(32e)
Internal Ceiling 2			30.9100			9.0000	278.1900	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	30140.5930 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		178.4629 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.5100	0.2360	5.5484
E3 Sill	17.7400	0.0220	0.3903
E4 Jamb	44.3000	0.0170	0.7531
E5 Ground floor (normal)	25.2000	0.0580	1.4616
E6 Intermediate floor within a dwelling	43.0300	0.0010	0.0430
E16 Corner (normal)	16.8600	0.0420	0.7081
E18 Party wall between dwellings	16.8600	0.0320	0.5395
R1 Head of roof window	1.6000	0.2400	0.3840
R2 Sill of roof window	1.6000	0.2400	0.3840
R3 Jamb of roof window	4.0600	0.2400	0.9744
E14 Flat roof	12.0500	0.0600	0.7230
P1 Party wall - Ground floor	11.9700	0.0430	0.5147
P4 Party wall - Roof (insulation at ceiling level)	3.8600	0.0400	0.1544
P2 Party wall - Intermediate floor within a dwelling	8.9700	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	7.0000	0.0570	0.3990
E12 Gable (insulation at ceiling level)	4.9000	0.0430	0.2107
E13 Gable (insulation at rafter level)	7.7000	0.0430	0.3311
E11 Eaves (insulation at rafter level)	11.1000	0.0180	0.1998

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.7191 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	108.5840 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	83.9641	83.7059	83.4538	82.9678	82.9678	81.8592	82.2844	81.8592	81.8592	82.5061	82.2844	83.2078	(38)
Heat transfer coeff	192.5482	192.2900	192.0379	191.5519	191.5519	190.4432	190.8684	190.4432	190.4432	191.0902	190.8684	191.7918	(39)
Average = Sum(39)m / 12 =												191.3273	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1401	1.1386	1.1371	1.1342	1.1342	1.1276	1.1301	1.1276	1.1276	1.1314	1.1301	1.1356	(40)
HLP (average)												1.1329	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9611 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
101.5678	100.0415	97.8172	93.5616	90.4210	86.9187	84.9280	87.1354	89.5551	93.3155	97.6626	101.1787	(42a)

Hot water usage for baths

31.8887	31.4151	30.7482	29.5185	28.5977	27.5767	27.0253	27.6875	28.4086	29.5011	30.7561	31.7809	(42b)

Hot water usage for other uses

44.9545	43.3198	41.6851	40.0503	38.4156	36.7809	36.7809	38.4156	40.0503	41.6851	43.3198	44.9545	(42c)

Average daily hot water use (litres/day)	164.0756 (43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
178.4110	174.7763	170.2504	163.1304	157.4344	151.2764	148.7342	153.2385	158.0140	164.5016	171.7384	177.9140	(44)
Energy conte 282.5593	248.8791	261.6686	223.3174	211.9370	186.0120	179.8811	189.7413	194.8471	223.2272	244.6728	278.5703	(45)

Energy content (annual)	Total = Sum(45)m = 2725.3133

Distribution loss (46)m = 0.15 x (45)m

42.3839	37.3319	39.2503	33.4976	31.7905	27.9018	26.9822	28.4612	29.2271	33.4841	36.7009	41.7855	(46)

Water storage loss:	
Store volume	200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	2.0000 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	1.0800 (55)

Total storage loss

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)

If cylinder contains dedicated solar storage

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

339.3017	300.1303	318.4110	278.2294	268.6794	240.9240	236.6235	246.4837	249.7591	279.9696	299.5848	335.3127	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

339.3017	300.1303	318.4110	278.2294	268.6794	240.9240	236.6235	246.4837	249.7591	279.9696	299.5848	335.3127	(64)

	Total per year (kWh/year) = Sum(64)m = 3393.4093 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

139.3449	123.7533	132.3987	118.1826	115.8630	105.7786	105.2044	108.4829	108.7163	119.6170	125.2833	138.0186	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.1132	40.9573	33.3087	25.2169	18.8499	15.9139	17.1955	22.3514	30.0000	38.0919	44.4588	47.3948	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	508.0835	513.3558	500.0697	471.7853	436.0812	402.5244	380.1064	374.8341	388.1202	416.4047	452.1087	485.6655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	(71)
Water heating gains (Table 5)													
	187.2915	184.1566	177.9553	164.1426	155.7298	146.9147	141.4038	145.8104	150.9948	160.7755	174.0046	185.5088	(72)
Total internal gains													
	856.4375	853.4191	826.2831	776.0940	725.6102	680.3023	653.6550	657.9452	684.0643	730.2213	785.5214	833.5184	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.2600	12.4928	0.6300	0.7500	0.7700	46.0609	(75)
Southwest	20.0800	39.1209	0.6300	0.7500	0.7700	257.2218	(79)
Northwest	5.9900	12.4928	0.6300	0.7500	0.7700	24.5031	(81)
Northeast	1.6200	29.0000	0.6300	0.7500	1.0000	19.9782	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	347.7640	559.9907	842.0355	1198.8974	1411.3238	1543.5468	1464.6882	1296.3558	1036.9108	697.6059	436.1098	288.4941	(83)
Total gains	1204.2015	1413.4098	1668.3186	1974.9914	2136.9340	2223.8491	2118.3432	1954.3010	1720.9751	1427.8271	1221.6313	1122.0125	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.4820	43.5404	43.5976	43.7082	43.7082	43.9626	43.8647	43.9626	43.9626	43.8138	43.8647	43.6535	
alpha	3.8988	3.9027	3.9065	3.9139	3.9139	3.9308	3.9243	3.9308	3.9308	3.9209	3.9243	3.9102	
util living area													
	0.9832	0.9688	0.9250	0.8145	0.6304	0.3957	0.2337	0.2717	0.5716	0.8670	0.9659	0.9867	(86)
Living	19.7868	19.9626	20.2972	20.6371	20.8423	20.9121	20.9206	20.9200	20.8821	20.6117	20.1406	19.7457	
Non living	18.5647	18.7868	19.2018	19.6007	19.8126	19.8735	19.8753	19.8774	19.8553	19.5864	19.0190	18.5156	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3794	19.9626	20.2972	20.6371	20.8423	20.9121	20.9206	20.9200	20.8821	20.6117	20.1406	19.9212	(87)
Th 2	19.9682	19.9695	19.9707	19.9730	19.9730	19.9783	19.9763	19.9783	19.9783	19.9752	19.9763	19.9719	(88)
util rest of house													
	0.9790	0.9613	0.9072	0.7746	0.5632	0.3127	0.1420	0.1732	0.4792	0.8265	0.9561	0.9833	(89)
MIT 2	19.4087	18.7868	19.2018	19.6007	19.8126	19.8735	19.8753	19.8774	19.8553	19.5864	19.0190	18.7780	(90)
Living area fraction									fLA = Living area / (4) =			0.3834	(91)
MIT	19.7808	19.2376	19.6218	19.9980	20.2074	20.2717	20.2760	20.2771	20.2489	19.9795	19.4490	19.2163	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7808	19.2376	19.6218	19.9980	20.2074	20.2717	20.2760	20.2771	20.2489	19.9795	19.4490	19.2163	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9781	0.9546	0.9001	0.7757	0.5793	0.3369	0.1689	0.2021	0.5048	0.8267	0.9497	0.9802	(94)
Useful gains	1177.8586	1349.2919	1501.5723	1532.0176	1237.8571	749.1513	357.7961	394.9782	868.6868	1180.3611	1160.2200	1099.7431	(95)
Ext temp.	5.3000	5.8000	7.7000	10.2000	13.3000	16.3000	18.4000	18.2000	15.5000	11.9000	8.2000	5.3000	(96)
Heat loss rate W													
	2788.2594	2583.9144	2289.4312	1876.8344	1323.1220	756.3837	358.0741	395.5699	904.4011	1543.9099	2147.0861	2669.0259	(97)
Space heating kWh													
	1198.1382	829.6663	586.1670	248.2681	63.4371	0.0000	0.0000	0.0000	0.0000	270.4803	710.5436	1167.5464	(98a)
Space heating requirement - total per year (kWh/year)												5074.2470	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1198.1382	829.6663	586.1670	248.2681	63.4371	0.0000	0.0000	0.0000	0.0000	270.4803	710.5436	1167.5464	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5074.2470	
Space heating per m2											(98c) / (4) =	30.0447	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	301.3356	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1198.1382	829.6663	586.1670	248.2681	63.4371	0.0000	0.0000	0.0000	0.0000	270.4803	710.5436	1167.5464	(98)
Space heating efficiency (main heating system 1)													
	301.3356	301.3356	301.3356	301.3356	301.3356	0.0000	0.0000	0.0000	0.0000	301.3356	301.3356	301.3356	(210)
Space heating fuel (main heating system)													
	397.6092	275.3297	194.5230	82.3892	21.0520	0.0000	0.0000	0.0000	0.0000	89.7605	235.7981	387.4572	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

Space heating fuel (secondary)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

Water heating requirement

	339.3017	300.1303	318.4110	278.2294	268.6794	240.9240	236.6235	246.4837	249.7591	279.9696	299.5848	335.3127 (64)
Efficiency of water heater												173.5321 (216)
(217)m	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321 (217)
Fuel for water heating, kWh/month												
	195.5268	172.9537	183.4882	160.3331	154.8298	138.8354	136.3572	142.0392	143.9267	161.3359	172.6394	193.2280 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	40.3626	32.3804	29.1550	21.3602	16.4992	13.4800	15.0511	19.5640	25.4117	33.3416	37.6592	41.4844 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1683.9189 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	173.5321
Water heating fuel used	1955.4934 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	325.7494 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3965.1617 (238)

10a. Fuel costs - using BEDF prices (554)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1683.9189	26.0600	438.8293	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1955.4934	26.0600	509.6016	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	325.7494	26.0600	84.8903	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1033.3211	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1683.9189	0.1569	264.1540	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1955.4934	0.1410	275.7521	(264)
Space and water heating			539.9061	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	325.7494	0.1443	47.0157	(268)
Total CO2, kg/year			586.9218	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1683.9189	1.5807	2661.7965	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1955.4934	1.5214	2975.1360	(278)
Space and water heating			5636.9325	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	325.7494	1.5338	499.6454	(282)
Total Primary energy kWh/year			6136.5779	(286)

SAP 10 EPC IMPROVEMENTS

19a

Current energy efficiency rating:	B 81
Current environmental impact rating:	A 96

N	Solar water heating	Recommended
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.5	-£ 93	-44 kg (7.6%)
U Solar photovoltaic panels	+ 4.3	-£ 255	-131 kg (24.2%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£93	0.26 kg/m²	B 82	A 96
Solar photovoltaic panels	£255	0.78 kg/m²	B 86	A 97
Total Savings	£349	1.04 kg/m²		

Potential energy efficiency rating: B 86
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 554 TEST (31 Oct 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£1033	£940	£93
Space heating	£439	£460	-£21
Water heating	£510	£395	£115
Lighting	£85	£85	£0
Generated (PV)	-£0	-£255	£255
Total cost of fuels	£1033	£685	£348
Total cost of uses	£1034	£685	£349
Delivered energy	23 kWh/m²	16 kWh/m²	8 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	3 kg/m²	2 kg/m²	1 kg/m²
Primary energy	36 kWh/m²	25 kWh/m²	12 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.2700 (1b)	x	2.7500 (2b)	=	220.7425	(1b) - (3b)
First floor	57.7100 (1c)	x	2.9300 (2c)	=	169.0903	(1c) - (3c)
Second floor	30.9100 (1d)	x	2.7500 (2d)	=	85.0025	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.8900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	474.8353	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1053 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0100 (17)
Infiltration rate		0.3558 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2491 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3176	0.3113	0.3051	0.2740	0.2677	0.2366	0.2366	0.2304	0.2491	0.2677	0.2802	0.2926	(22b)
Effective ac	0.5504	0.5485	0.5465	0.5375	0.5358	0.5280	0.5280	0.5265	0.5310	0.5358	0.5393	0.5428	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.20)			37.3300	1.1450	42.7443			(27)
door			2.2200	1.2000	2.6640			(26)

RL			1.6200	1.1450	1.8550		(27a)
Heatloss Floor 1			80.2700	0.1300	10.4351	110.0000	8829.7000 (28a)
External Wall 1	127.5743	33.8800	93.6943	0.1800	16.8650	110.0000	10306.3730 (29a)
Wall in roof	45.7000		45.7000	0.1700	7.7690	9.0000	411.3000 (29a)
Dorma Wall	18.5900	5.6700	12.9200	0.1800	2.3256	9.0000	116.2800 (29a)
External Roof	26.8000		26.8000	0.1100	2.9480	9.0000	241.2000 (30)
Green Roof	27.6900		27.6900	0.1400	3.8766	9.0000	249.2100 (30)
Sloped Roof	25.7800	1.6200	24.1600	0.1400	3.3824	9.0000	217.4400 (30)
Total net area of external elements Aum(A, m2)			352.4043				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.8649		(33)
Party Wall 1			69.8200	0.0000	0.0000	70.0000	4887.4000 (32)
Internal Wall 1			276.5500			9.0000	2488.9500 (32c)
Internal Floor 1			30.9100			18.0000	556.3800 (32d)
Internal Floor 2			57.7100			18.0000	1038.7800 (32d)
Internal Ceiling 1			57.7100			9.0000	519.3900 (32e)
Internal Ceiling 2			30.9100			9.0000	278.1900 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	30140.5930 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		178.4629 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.5100	0.2360	5.5484
E3 Sill	17.7400	0.0220	0.3903
E4 Jamb	44.3000	0.0170	0.7531
E5 Ground floor (normal)	25.2000	0.0580	1.4616
E6 Intermediate floor within a dwelling	43.0300	0.0010	0.0430
E16 Corner (normal)	16.8600	0.0420	0.7081
E18 Party wall between dwellings	16.8600	0.0320	0.5395
R1 Head of roof window	1.6000	0.2400	0.3840
R2 Sill of roof window	1.6000	0.2400	0.3840
R3 Jamb of roof window	4.0600	0.2400	0.9744
E14 Flat roof	12.0500	0.0600	0.7230
P1 Party wall - Ground floor	11.9700	0.0430	0.5147
P4 Party wall - Roof (insulation at ceiling level)	3.8600	0.0400	0.1544
P2 Party wall - Intermediate floor within a dwelling	8.9700	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	7.0000	0.0570	0.3990
E12 Gable (insulation at ceiling level)	4.9000	0.0430	0.2107
E13 Gable (insulation at rafter level)	7.7000	0.0430	0.3311
E11 Eaves (insulation at rafter level)	11.1000	0.0180	0.1998

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.7191 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	108.5840 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	86.2483	85.9415	85.6408	84.2284	83.9641	82.7340	82.7340	82.5061	83.2078	83.9641	84.4987	85.0576	(38)
Heat transfer coeff	194.8324	194.5256	194.2249	192.8124	192.5482	191.3180	191.3180	191.0902	191.7918	192.5482	193.0828	193.6417	(39)
Average = Sum(39)m / 12 =												192.8112	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1536	1.1518	1.1500	1.1416	1.1401	1.1328	1.1328	1.1314	1.1356	1.1401	1.1432	1.1466	(40)
HLP (average)												1.1416	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.9611	(42)
Hot water usage for mixer showers	101.5678	100.0415	97.8172	93.5616	90.4210	86.9187	84.9280	87.1354	89.5551	93.3155	97.6626	101.1787	(42a)
Hot water usage for baths	31.8887	31.4151	30.7482	29.5185	28.5977	27.5767	27.0253	27.6875	28.4086	29.5011	30.7561	31.7809	(42b)
Hot water usage for other uses	44.9545	43.3198	41.6851	40.0503	38.4156	36.7809	36.7809	38.4156	40.0503	41.6851	43.3198	44.9545	(42c)
Average daily hot water use (litres/day)												164.0756	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	178.4110	174.7763	170.2504	163.1304	157.4344	151.2764	148.7342	153.2385	158.0140	164.5016	171.7384	177.9140	(44)
Energy conte	282.5593	248.8791	261.6686	223.3174	211.9370	186.0120	179.8811	189.7413	194.8471	223.2272	244.6728	278.5703	(45)
Energy content (annual)										Total = Sum(45)m =		2725.3133	
Distribution loss (46)m = 0.15 x (45)m	42.3839	37.3319	39.2503	33.4976	31.7905	27.9018	26.9822	28.4612	29.2271	33.4841	36.7009	41.7855	(46)

Water storage loss:		
Store volume	200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	2.0000	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	1.0800	(55)

Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	339.3017	300.1303	317.0153	271.4758	255.8851	228.3173	223.5966	234.3873	244.3562	278.5738	299.5848	335.3127	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector	3.0000	(H1)
Zero-loss collector efficiency	0.8000	(H2)
Collector linear heat loss coefficient	1.8000	(H3)
Collector 2nd order heat loss coefficient	0.0000	(H4)
Collector loop efficiency	0.9000	(H5)
Incidence angle modifier	1.0000	(H6)
Overshading factor	0.8000	(H8)
Overall heat loss coefficient of system	6.5000	(H10)
Heat loss coefficient of collector loop	3.9667	(H11)
Dedicated solar storage volume	75.0000	(H12)
Effective solar volume	75.0000	(H14)
Reference volume	225.0000	(H15)
Storage tank correction coefficient	1.3161	(H16)
Heat delivered to hot water	651.3087	(H24)
Heat delivered to space heating	0.0000	(H29)
Solar input	651.3087	

Solar input	-0.0000	-16.1668	-59.8134	-83.4877	-110.8439	-102.4697	-101.8628	-88.0847	-59.6894	-28.8903	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	339.3017	283.9635	257.2019	187.9881	145.0412	125.8476	121.7338	146.3026	184.6668	249.6835	299.5848	335.3127	(64)

Total per year (kWh/year) = Sum(64)m = 2676.6282 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

139.3449	123.7533	131.2821	112.7798	105.6275	95.6932	94.7828	98.8058	104.3940	118.5004	125.2833	138.0186	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

46.1132	40.9573	33.3087	25.2169	18.8499	15.9139	17.1955	22.3514	30.0000	38.0919	44.4588	47.3948	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

508.0835	513.3558	500.0697	471.7853	436.0812	402.5244	380.1064	374.8341	388.1202	416.4047	452.1087	485.6655	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	(69)

Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	(71)

Water heating gains (Table 5)

187.2915	184.1566	176.4545	156.6386	141.9725	132.9072	127.3963	132.8034	144.9916	159.2747	174.0046	185.5088	(72)

Total internal gains

856.4375	853.4191	824.7823	768.5900	711.8529	666.2948	639.6475	644.9382	678.0611	728.7205	785.5214	833.5184	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.2600	11.2829	0.6300	0.7500	0.7700	41.6002	(75)
Southwest	20.0800	36.7938	0.6300	0.7500	0.7700	241.9211	(79)
Northwest	5.9900	11.2829	0.6300	0.7500	0.7700	22.1301	(81)
Northeast	1.6200	26.0000	0.6300	0.7500	1.0000	17.9115	(82)

Solar gains	323.5630	579.0071	863.6855	1185.7860	1430.7278	1464.6882	1393.7364	1204.7550	974.5253	659.4395	392.6889	273.5465	(83)
Total gains	1180.0005	1432.4261	1688.4678	1954.3759	2142.5807	2130.9831	2033.3839	1849.6932	1652.5864	1388.1599	1178.2103	1107.0649	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.9723	43.0400	43.1067	43.4224	43.4820	43.7616	43.7616	43.8138	43.6535	43.4820	43.3616	43.2365	
alpha	3.8648	3.8693	3.8738	3.8948	3.8988	3.9174	3.9174	3.9209	3.9102	3.8988	3.8908	3.8824	
util living area													
	0.9873	0.9731	0.9398	0.8595	0.7191	0.5447	0.4062	0.4614	0.7000	0.9118	0.9768	0.9899	(86)
Living	19.6363	19.8515	20.1640	20.5182	20.7668	20.8819	20.9115	20.9055	20.8183	20.4665	19.9761	19.5923	
Non living	18.3648	18.6378	19.0286	19.4591	19.7340	19.8481	19.8691	19.8673	19.7958	19.4116	18.8037	18.3131	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3024	19.8515	20.1640	20.5182	20.7668	20.8819	20.9115	20.9055	20.8183	20.4665	19.9761	19.7892	(87)
Th 2	19.9573	19.9588	19.9602	19.9670	19.9682	19.9741	19.9741	19.9752	19.9719	19.9682	19.9657	19.9630	(88)
util rest of house													
	0.9842	0.9669	0.9261	0.8291	0.6648	0.4677	0.3150	0.3646	0.6243	0.8852	0.9704	0.9875	(89)
MIT 2	19.3224	18.6378	19.0286	19.4591	19.7340	19.8481	19.8691	19.8673	19.7958	19.4116	18.8037	18.6105	(90)
Living area fraction										fLA = Living area / (4) =		0.3834	(91)
MIT	19.6981	19.1031	19.4639	19.8651	20.1300	20.2444	20.2687	20.2653	20.1878	19.8161	19.2532	19.0624	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6981	19.1031	19.4639	19.8651	20.1300	20.2444	20.2687	20.2653	20.1878	19.8161	19.2532	19.0624	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9833	0.9605	0.9183	0.8257	0.6739	0.4887	0.3417	0.3927	0.6414	0.8805	0.9647	0.9848	(94)
Useful gains	1160.3535	1375.8115	1550.5004	1613.7963	1443.8422	1041.3680	694.7341	726.3586	1059.9521	1222.3284	1136.5802	1090.2180	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	3000.0506	2762.8748	2517.9156	2114.2170	1623.1726	1079.8828	701.8968	738.6232	1167.5881	1774.5385	2346.5714	2877.9720	(97)
Space heating kWh													
	1368.7346	932.1065	719.7570	360.3029	133.4218	0.0000	0.0000	0.0000	0.0000	410.8443	871.1937	1330.0890	(98a)
Space heating requirement - total per year (kWh/year)												6126.4497	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1368.7346	932.1065	719.7570	360.3029	133.4218	0.0000	0.0000	0.0000	0.0000	410.8443	871.1937	1330.0890	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6126.4497	
Space heating per m2											(98c) / (4) =	36.2748	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	301.5869	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	1368.7346	932.1065	719.7570	360.3029	133.4218	0.0000	0.0000	0.0000	0.0000	410.8443	871.1937	1330.0890	(98)
Space heating efficiency (main heating system 1)													
	301.5869	301.5869	301.5869	301.5869	301.5869	0.0000	0.0000	0.0000	0.0000	301.5869	301.5869	301.5869	(210)
Space heating fuel (main heating system)													
	453.8443	309.0674	238.6566	119.4690	44.2399	0.0000	0.0000	0.0000	0.0000	136.2275	288.8699	441.0302	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	339.3017	283.9635	257.2019	187.9881	145.0412	125.8476	121.7338	146.3026	184.6668	249.6835	299.5848	335.3127	(64)
Efficiency of water heater												173.5403	(216)
(217)m	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	173.5403	(217)
Fuel for water heating, kWh/month													
	195.5175	163.6297	148.2087	108.3253	83.5778	72.5178	70.1472	84.3046	106.4115	143.8763	172.6312	193.2189	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	40.3626	32.3804	29.1550	21.3602	16.4992	13.4800	15.0511	19.5640	25.4117	33.3416	37.6592	41.4844	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.4969	-61.3195	-93.3895	-108.3787	-116.6265	-106.5836	-104.9951	-97.9359	-85.1475	-71.0040	-45.6333	-34.4235	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2031.4048	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	173.5403	
Water heating fuel used	1542.3665	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	80.0000	(231)
Electricity for lighting (calculated in Appendix L)	325.7494	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-965.9340	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3013.5867	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2031.4048	16.4900	334.9786	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1542.3665	16.4900	254.3362	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	325.7494	16.4900	53.7161	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-965.9340	16.4900	-159.2825	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-159.2825	(252)
Total energy cost			496.9404	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8364	(257)
SAP value	86.4419	
SAP rating (Section 12)	86	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2031.4048	0.1560	316.8998	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1542.3665	0.1448	223.2908	(264)
Space and water heating			540.1906	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	325.7494	0.1443	47.0157	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-965.9340	0.1341	-129.5531	

PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-129.5531 (269)
Total CO2, kg/year			468.7502 (272)
CO2 emissions per m2			2.7800 (273)
EI value			97.0633
EI rating			97 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.2700	(1b)	x 2.7500	(2b) =	220.7425	(1b) - (3b)
First floor	57.7100	(1c)	x 2.9300	(2c) =	169.0903	(1c) - (3c)
Second floor	30.9100	(1d)	x 2.7500	(2d) =	85.0025	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.8900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		474.8353	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1053 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0100 (17)
Infiltration rate		0.3558 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2491 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.2000	4.1000	3.9000	3.9000	3.4000	3.6000	3.4000	3.4000	3.7000	3.6000	4.0000	(22)
Wind factor	1.0750	1.0500	1.0250	0.9750	0.9750	0.8500	0.9000	0.8500	0.8500	0.9250	0.9000	1.0000	(22a)
Adj infilt rate	0.2677	0.2615	0.2553	0.2428	0.2428	0.2117	0.2242	0.2117	0.2117	0.2304	0.2242	0.2491	(22b)
Effective ac	0.5358	0.5342	0.5326	0.5295	0.5295	0.5224	0.5251	0.5224	0.5224	0.5265	0.5251	0.5310	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.20)			37.3300	1.1450	42.7443			(27)
door			2.2200	1.2000	2.6640			(26)
RL			1.6200	1.1450	1.8550			(27a)
Heatloss Floor 1			80.2700	0.1300	10.4351	110.0000	8829.7000	(28a)
External Wall 1	127.5743	33.8800	93.6943	0.1800	16.8650	110.0000	10306.3730	(29a)
Wall in roof	45.7000		45.7000	0.1700	7.7690	9.0000	411.3000	(29a)
Dorma Wall	18.5900	5.6700	12.9200	0.1800	2.3256	9.0000	116.2800	(29a)
External Roof	26.8000		26.8000	0.1100	2.9480	9.0000	241.2000	(30)
Green Roof	27.6900		27.6900	0.1400	3.8766	9.0000	249.2100	(30)
Sloped Roof	25.7800	1.6200	24.1600	0.1400	3.3824	9.0000	217.4400	(30)
Total net area of external elements Aum(A, m2)			352.4043					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.8649			(33)
Party Wall 1			69.8200	0.0000	0.0000	70.0000	4887.4000	(32)
Internal Wall 1			276.5500			9.0000	2488.9500	(32c)
Internal Floor 1			30.9100			18.0000	556.3800	(32d)
Internal Floor 2			57.7100			18.0000	1038.7800	(32d)
Internal Ceiling 1			57.7100			9.0000	519.3900	(32e)
Internal Ceiling 2			30.9100			9.0000	278.1900	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	30140.5930 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		178.4629 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.5100	0.2360	5.5484
E3 Sill	17.7400	0.0220	0.3903
E4 Jamb	44.3000	0.0170	0.7531
E5 Ground floor (normal)	25.2000	0.0580	1.4616
E6 Intermediate floor within a dwelling	43.0300	0.0010	0.0430
E16 Corner (normal)	16.8600	0.0420	0.7081
E18 Party wall between dwellings	16.8600	0.0320	0.5395
R1 Head of roof window	1.6000	0.2400	0.3840
R2 Sill of roof window	1.6000	0.2400	0.3840
R3 Jamb of roof window	4.0600	0.2400	0.9744
E14 Flat roof	12.0500	0.0600	0.7230

P1 Party wall - Ground floor	11.9700	0.0430	0.5147	
P4 Party wall - Roof (insulation at ceiling level)	3.8600	0.0400	0.1544	
P2 Party wall - Intermediate floor within a dwelling	8.9700	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	7.0000	0.0570	0.3990	
E12 Gable (insulation at ceiling level)	4.9000	0.0430	0.2107	
E13 Gable (insulation at rafter level)	7.7000	0.0430	0.3311	
E11 Eaves (insulation at rafter level)	11.1000	0.0180	0.1998	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7191 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 108.5840 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	83.9641	83.7059	83.4538	82.9678	82.9678	81.8592	82.2844	81.8592	81.8592	82.5061	82.2844	83.2078	(38)
Heat transfer coeff	192.5482	192.2900	192.0379	191.5519	191.5519	190.4432	190.8684	190.4432	190.4432	191.0902	190.8684	191.7918	(39)
Average = Sum(39)m / 12 =												191.3273	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1401	1.1386	1.1371	1.1342	1.1342	1.1276	1.1301	1.1276	1.1276	1.1314	1.1301	1.1356	(40)
HLP (average)												1.1329	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9611 (42)
Hot water usage for mixer showers

101.5678	100.0415	97.8172	93.5616	90.4210	86.9187	84.9280	87.1354	89.5551	93.3155	97.6626	101.1787	(42a)

Hot water usage for baths

31.8887	31.4151	30.7482	29.5185	28.5977	27.5767	27.0253	27.6875	28.4086	29.5011	30.7561	31.7809	(42b)

Hot water usage for other uses

44.9545	43.3198	41.6851	40.0503	38.4156	36.7809	36.7809	38.4156	40.0503	41.6851	43.3198	44.9545	(42c)

Average daily hot water use (litres/day) 164.0756 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	178.4110	174.7763	170.2504	163.1304	157.4344	151.2764	148.7342	153.2385	158.0140	164.5016	171.7384	177.9140	(44)
Energy conte	282.5593	248.8791	261.6686	223.3174	211.9370	186.0120	179.8811	189.7413	194.8471	223.2272	244.6728	278.5703	(45)
Energy content (annual)										Total = Sum(45)m =		2725.3133	
Distribution loss (46)m = 0.15 x (45)m	42.3839	37.3319	39.2503	33.4976	31.7905	27.9018	26.9822	28.4612	29.2271	33.4841	36.7009	41.7855	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.0000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0800 (55)
Total storage loss

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)

If cylinder contains dedicated solar storage

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss 23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

339.3017	300.1303	317.0153	271.4758	255.8851	228.3173	223.5966	234.3873	244.3562	278.5738	299.5848	335.3127	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector 3.0000 (H1)
Zero-loss collector efficiency 0.8000 (H2)
Collector linear heat loss coefficient 1.8000 (H3)
Collector 2nd order heat loss coefficient 0.0000 (H4)
Collector loop efficiency 0.9000 (H5)
Incidence angle modifier 1.0000 (H6)
Overshading factor 0.8000 (H8)
Overall heat loss coefficient of system 6.5000 (H10)
Heat loss coefficient of collector loop 3.9667 (H11)
Dedicated solar storage volume 75.0000 (H12)
Effective solar volume 75.0000 (H14)
Reference volume 225.0000 (H15)
Storage tank correction coefficient 1.3161 (H16)
Heat delivered to hot water 697.3310 (H24)
Heat delivered to space heating 0.0000 (H29)
Solar input 697.3310

Solar input -0.0000	-15.7908	-59.2863	-86.3087	-110.6726	-110.6007	-109.8196	-98.8007	-67.7492	-35.3982	-2.9042	-0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

339.3017	284.3395	257.7290	185.1671	145.2125	117.7166	113.7770	135.5866	176.6070	243.1756	296.6806	335.3127	(64)
									Total per year (kWh/year) = Sum(64)m =		2630.6059	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

139.3449	123.7533	131.2821	112.7798	105.6275	95.6932	94.7828	98.8058	104.3940	118.5004	125.2833	138.0186	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	177.6651	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1132	40.9573	33.3087	25.2169	18.8499	15.9139	17.1955	22.3514	30.0000	38.0919	44.4588	47.3948	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	508.0835	513.3558	500.0697	471.7853	436.0812	402.5244	380.1064	374.8341	388.1202	416.4047	452.1087	485.6655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	55.7276	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	-118.4434	(71)
Water heating gains (Table 5)	187.2915	184.1566	176.4545	156.6386	141.9725	132.9072	127.3963	132.8034	144.9916	159.2747	174.0046	185.5088	(72)
Total internal gains	856.4375	853.4191	824.7823	768.5900	711.8529	666.2948	639.6475	644.9382	678.0611	728.7205	785.5214	833.5184	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.2600	12.4928	0.6300	0.7500	0.7700	46.0609	(75)
Southwest	20.0800	39.1209	0.6300	0.7500	0.7700	257.2218	(79)
Northwest	5.9900	12.4928	0.6300	0.7500	0.7700	24.5031	(81)
Northeast	1.6200	29.0000	0.6300	0.7500	1.0000	19.9782	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	347.7640	559.9907	842.0355	1198.8974	1411.3238	1543.5468	1464.6882	1296.3558	1036.9108	697.6059	436.1098	288.4941	(83)
Total gains	1204.2015	1413.4098	1666.8178	1967.4874	2123.1766	2209.8417	2104.3358	1941.2940	1714.9719	1426.3263	1221.6313	1122.0125	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.4820	43.5404	43.5976	43.7082	43.7082	43.9626	43.8647	43.9626	43.9626	43.8138	43.8647	43.6535	
alpha	3.8988	3.9027	3.9065	3.9139	3.9139	3.9308	3.9243	3.9308	3.9308	3.9209	3.9243	3.9102	
util living area	0.9832	0.9688	0.9252	0.8160	0.6335	0.3981	0.2352	0.2734	0.5732	0.8673	0.9659	0.9867	(86)
Living	19.7868	19.9626	20.2965	20.6350	20.8409	20.9119	20.9205	20.9200	20.8817	20.6112	20.1406	19.7457	
Non living	18.5647	18.7868	19.2010	19.5986	19.8115	19.8734	19.8753	19.8774	19.8550	19.5859	19.0190	18.5156	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3794	19.9626	20.2965	20.6350	20.8409	20.9119	20.9205	20.9200	20.8817	20.6112	20.1406	19.9212	(87)
Th 2	19.9682	19.9695	19.9707	19.9730	19.9730	19.9783	19.9763	19.9783	19.9783	19.9752	19.9763	19.9719	(88)
util rest of house	0.9790	0.9613	0.9074	0.7762	0.5662	0.3146	0.1429	0.1743	0.4807	0.8269	0.9561	0.9833	(89)
MIT 2	19.4087	18.7868	19.2010	19.5986	19.8115	19.8734	19.8753	19.8774	19.8550	19.5859	19.0190	18.7780	(90)
Living area fraction									fLA = Living area / (4) =			0.3834	(91)
MIT	19.7808	19.2376	19.6210	19.9960	20.2062	20.2716	20.2760	20.2771	20.2486	19.9789	19.4490	19.2163	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7808	19.2376	19.6210	19.9960	20.2062	20.2716	20.2760	20.2771	20.2486	19.9789	19.4490	19.2163	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9781	0.9546	0.9003	0.7772	0.5822	0.3389	0.1700	0.2035	0.5063	0.8270	0.9497	0.9802	(94)
Useful gains	1177.8586	1349.2919	1500.5753	1529.1399	1236.1302	748.9685	357.7875	394.9603	868.2577	1179.6344	1160.2200	1099.7431	(95)
Ext temp.	5.3000	5.8000	7.7000	10.2000	13.3000	16.3000	18.4000	18.2000	15.5000	11.9000	8.2000	5.3000	(96)
Heat loss rate W	2788.2594	2583.9144	2289.2881	1876.4342	1322.8930	756.3586	358.0724	395.5666	904.3438	1543.8075	2147.0861	2669.0259	(97)
Space heating kWh	1198.1382	829.6663	586.8023	250.0520	64.5515	0.0000	0.0000	0.0000	0.0000	270.9448	710.5436	1167.5464	(98a)
Space heating requirement - total per year (kWh/year)												5078.2451	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1198.1382	829.6663	586.8023	250.0520	64.5515	0.0000	0.0000	0.0000	0.0000	270.9448	710.5436	1167.5464	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5078.2451	
Space heating per m2											(98c) / (4) =	30.0684	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	301.3356	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1198.1382	829.6663	586.8023	250.0520	64.5515	0.0000	0.0000	0.0000	0.0000	270.9448	710.5436	1167.5464	(98)
Space heating efficiency (main heating system 1)	301.3356	301.3356	301.3356	301.3356	301.3356	0.0000	0.0000	0.0000	0.0000	301.3356	301.3356	301.3356	(210)
Space heating fuel (main heating system)	397.6092	275.3297	194.7338	82.9812	21.4218	0.0000	0.0000	0.0000	0.0000	89.9146	235.7981	387.4572	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	339.3017	284.3395	257.7290	185.1671	145.2125	117.7166	113.7770	135.5866	176.6070	243.1756	296.6806	335.3127	(64)
Efficiency of water heater												173.5321	(216)
(217)m	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	173.5321	(217)
Fuel for water heating, kWh/month	195.5268	163.8541	148.5195	106.7048	83.6805	67.8356	65.5654	78.1334	101.7719	140.1329	170.9658	193.2280	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	40.3626	32.3804	29.1550	21.3602	16.4992	13.4800	15.0511	19.5640	25.4117	33.3416	37.6592	41.4844	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2321	-59.5841	-90.6886	-107.1088	-113.4300	-109.2072	-107.4123	-101.8322	-88.6220	-73.2399	-49.8008	-36.1855	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1685.2457	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	173.5321	
Water heating fuel used	1515.9186	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	80.0000	(231)
Electricity for lighting (calculated in Appendix L)	325.7494	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-980.3433	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2626.5704	(238)

10a. Fuel costs - using BEDF prices (554)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1685.2457	26.0600	439.1750	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1515.9186	26.0600	395.0484	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	325.7494	26.0600	84.8903	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-980.3433	26.0600	-255.4775	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-255.4775	(252)
Total energy cost			684.4843	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1685.2457	0.1569	264.3407	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1515.9186	0.1452	220.0708	(264)
Space and water heating			484.4116	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	325.7494	0.1443	47.0157	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-980.3433	0.1340	-131.3684	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-131.3684	(269)
Total CO2, kg/year			411.1558	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1685.2457	1.5807	2663.8146	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1515.9186	1.5370	2329.9539	(278)
Space and water heating			4993.7685	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	325.7494	1.5338	499.6454	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-980.3433	1.4952	-1465.8267	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1465.8267	(283)
Total Primary energy kWh/year			4148.6111	(286)

Predicted Energy Assessment

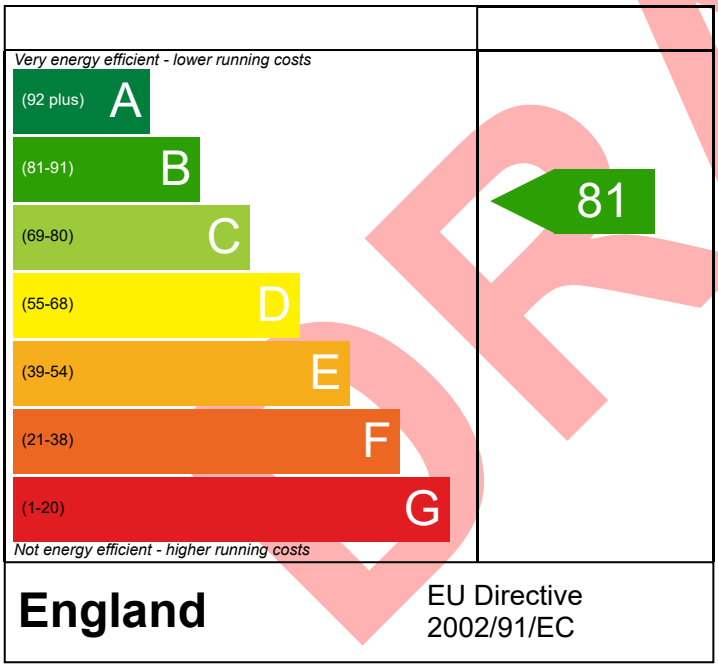
19a, Mendelik Road, London, NW2 3RJ

Dwelling type:	House, Semi-Detached
Date of assessment:	02/12/2024
Produced by:	Darren Coham
Total floor area:	168.89 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

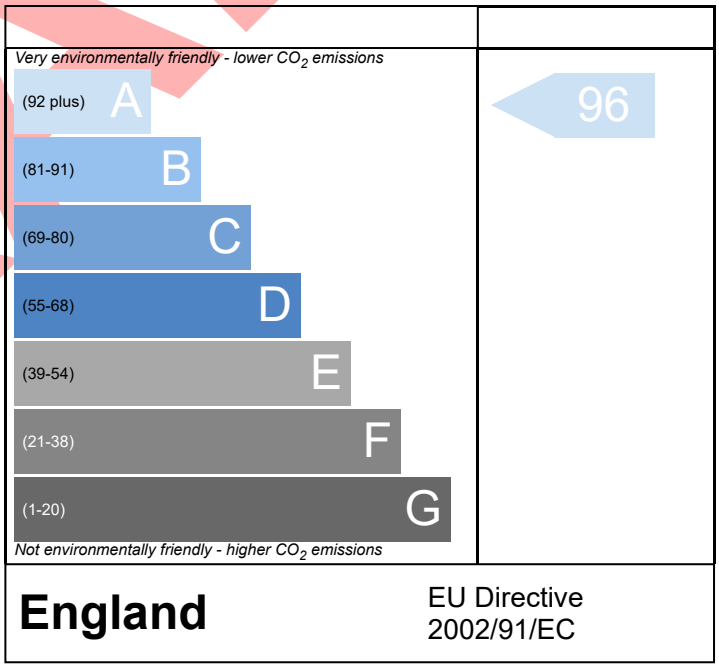
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data

elmhurst energy

Property Reference	19A	**Issued on Date**	02/12/2024
Assessment Reference	19a	**Prop Type Ref**	19A
Property	19a, Mendelik Road, London, NW2 3RJ		

SAP Rating	81 B	**DER**	3.86	**TER**	9.47
Environmental	96 A	**% DER < TER**			59.24
CO_2 Emissions (t/year)	0.59	**DFEE**	41.32	**TFEE**	42.23
Compliance Check	See BREL	**% DFEE < TFEE**			2.17
% DPER < TPER	18.73	**DPER**	40.32	**TPER**	49.61

Assessor Details	Mr. Darren Coham	**Assessor ID**	R789-0001
Client	RT, RT Architectural Consultants		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	House, Semi-Detached	
2.0 Number of Storeys	3	
3.0 Date Built	2024	
4.0 Sheltered Sides	4	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	178.46	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	No	

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	25.20 m	80.27 m²	2.75 m
1st Storey:	23.51 m	57.71 m²	2.93 m
2nd Storey:	19.52 m	30.91 m²	2.75 m

8.0 Living Area	64.75	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall 1	Cavity Wall	Cavity wall; plasterboard on dabs or battens, lightweight aggregate block, filled cavity, any outside structure	0.18	110.00	127.57	93.71	0.00	None	33.86	Calculate Wall Area
Wall in roof	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	45.70	45.70	0.50	Room In Roof	0.00	Enter Gross Area
Dorma Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	18.59	12.92	0.00	None	5.67	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill	0.00	70.00	69.82		None

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	276.55

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	26.80	26.80	None	0.00	Calculate Wall Area	0.00
Green Roof	External Flat Roof	Plasterboard, insulated flat roof	0.14	9.00	27.69	27.69	None	0.00	Enter Gross Area	0.00
Sloped Roof	External Slope Roof	Plasterboard, insulated slope	0.14	9.00	25.78	24.16	None	0.00	Enter Gross Area	1.62

Summary for Input Data

elmhurst energy

10.2 Internal Ceilings

Description	Storey	Construction	Area (m²)
Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	57.71
Internal Ceiling 2	+2	Plasterboard ceiling, carpeted chipboard floor	30.91

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.13	None	0.00	110.00	80.27

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	30.91
Internal Floor 2		Plasterboard ceiling, carpeted chipboard floor	9.00	57.71

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.75	1.20
roof windows	Manufacturer	Roof Window	Double Low-E Soft 0.05			0.63		0.75	1.20
half glazed door	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.75	1.20
door	Manufacturer	Solid Door				0.00			1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
BF1	windows	External Wall 1	South West	10.49	
FW1	windows	External Wall 1	South West	3.92	
SW1	windows	Dorma Wall	South West	5.67	
W1	windows	External Wall 1	North West	1.20	
FW2	windows	External Wall 1	North West	2.39	
SW2	windows	External Wall 1	North West	1.20	
ED	door	External Wall 1	North	2.22	
W3	windows	External Wall 1	North East	5.05	
W2	windows	External Wall 1	North West	1.20	
FW3	windows	External Wall 1	North East	5.05	
FW4	windows	External Wall 1	North East	1.16	
RL	roof windows	Sloped Roof	North East	1.62	0

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Gov Approved Scheme	23.51	0.24	0.24	Yes
E3 Sill	Gov Approved Scheme	17.74	0.02	0.02	No
E4 Jamb	Gov Approved Scheme	44.30	0.02	0.02	Yes
E5 Ground floor (normal)	Gov Approved Scheme	25.20	0.06	0.06	Yes
E6 Intermediate floor within a dwelling	Gov Approved Scheme	43.03	0.00	0.00	Yes
E16 Corner (normal)	Gov Approved Scheme	16.86	0.04	0.04	Yes
E18 Party wall between dwellings	Gov Approved Scheme	16.86	0.03	0.03	Yes
R1 Head of roof window	Table K1 - Default	1.60	0.24	0.24	Yes
R2 Sill of roof window	Table K1 - Default	1.60	0.24	0.24	Yes
R3 Jamb of roof window	Table K1 - Default	4.06	0.24	0.24	Yes
E14 Flat roof	Gov Approved Scheme	12.05	0.06	0.06	No
P1 Party wall - Ground floor	Gov Approved Scheme	11.97	0.04	0.04	No
P4 Party wall - Roof (insulation at ceiling level)	Gov Approved Scheme	3.86	0.04	0.04	No
P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	8.97	0.00	0.00	No
E10 Eaves (insulation at ceiling level)	Gov Approved Scheme	7.00	0.06	0.06	No
E12 Gable (insulation at ceiling level)	Gov Approved Scheme	4.90	0.04	0.04	No
E13 Gable (insulation at rafter level)	Gov Approved Scheme	7.70	0.04	0.04	No
E11 Eaves (insulation at rafter level)	Gov Approved Scheme	11.10	0.02	0.02	No

Y-value: 0.04 W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present: No

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys	0
Number of open flues	0
Number of chimneys/flues attached to closed fire	0
Number of flues attached to solid fuel boiler	0
Number of flues attached to other heater	0
Number of blocked chimneys	0

Summary for Input Data

elmhurst energy

Number of intermittent extract fans	5	
Number of passive vents	0	
Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Pressure Testing	Yes	
Designed AP_{50}	5.01	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	
22.0 Lighting		
No Fixed Lighting	No	

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	4.00	400.00	25

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	105264	
Fuel Type	Electricity	
In Winter	301.59	
In Summer	173.54	
Model Name	EBLA14DA3V3	
Manufacturer	Daikin Europe NV	
System Type	Heat Pump	
Controls SAP Code	2207	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	Enter value	
Flow Temperature Value	45.00	
25.0 Main Heating 2	None	
26.0 Heat Networks	None	
27.0 Secondary Heating	None	
28.0 Water Heating		
Water Heating	Main Heating 1	
SAP Code	901	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
Cold Water Source	From mains	
Bath Count	1	
Immersion Only Heating Hot Water	No	

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
1	Combi boiler or unvented hot water system	11.00		No	
2	Combi boiler or unvented hot water system	11.00		No	

28.3 Waste Water Heat Recovery System

Summary for Input Data

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	2.00	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	
31.0 Thermal Store	None	
34.0 Small-scale Hydro	None	

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
	£4,000 - £6,000	£93	B 82	A 96
	£3,500 - £5,500	£255	B 86	A 97
			0	0

Thermal Bridging

elmhurst energy

Property Reference	19A	**Issued on Date**	02/12/2024
Assessment Reference	19a	**Prop Type Ref**	Semi-Detached House
Property	19a, Mendelik Road, London, NW2 3RJ		

SAP Rating	81 B	**DER**	3.86	**TER**	9.47
Environmental	96 A	**% DER < TER**			59.24
CO_2 Emissions (t/year)	0.59	**DFEE**	41.32	**TFEE**	42.23
Compliance Check	See BREL	**% DFEE < TFEE**			2.17
% DPER < TPER	18.73	**DPER**	40.32	**TPER**	49.61

Assessor Details	Mr. Darren Coham	**Assessor ID**	R789-0001
Client	RT, RT Architectural Consultants		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Gov Approved Scheme	0.236	23.51	5.55	
External wall	E3 Sill	Gov Approved Scheme	0.022	17.74	0.39	
External wall	E4 Jamb	Gov Approved Scheme	0.017	44.30	0.75	
External wall	E5 Ground floor (normal)	Gov Approved Scheme	0.058	25.20	1.46	
External wall	E6 Intermediate floor within a dwelling	Gov Approved Scheme	0.001	43.03	0.04	
External wall	E16 Corner (normal)	Gov Approved Scheme	0.042	16.86	0.71	
External wall	E18 Party wall between dwellings	Gov Approved Scheme	0.032	16.86	0.54	
External roof	R1 Head of roof window	Table K1 - Default	0.240	1.60	0.38	
External roof	R2 Sill of roof window	Table K1 - Default	0.240	1.60	0.38	
External roof	R3 Jamb of roof window	Table K1 - Default	0.240	4.06	0.97	
External wall	E14 Flat roof	Gov Approved Scheme	0.060	12.05	0.72	
Party wall	P1 Party wall - Ground floor	Gov Approved Scheme	0.043	11.97	0.51	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Gov Approved Scheme	0.040	3.86	0.15	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.97	0.00	
External wall	E10 Eaves (insulation at ceiling level)	Gov Approved Scheme	0.057	7.00	0.40	
External wall	E12 Gable (insulation at ceiling level)	Gov Approved Scheme	0.043	4.90	0.21	
External wall	E13 Gable (insulation at rafter level)	Gov Approved Scheme	0.043	7.70	0.33	
External wall	E11 Eaves (insulation at rafter level)	Gov Approved Scheme	0.018	11.10	0.20	

Total: 262.31 W/mK:

Y-Value: 0.04 W/m²K:

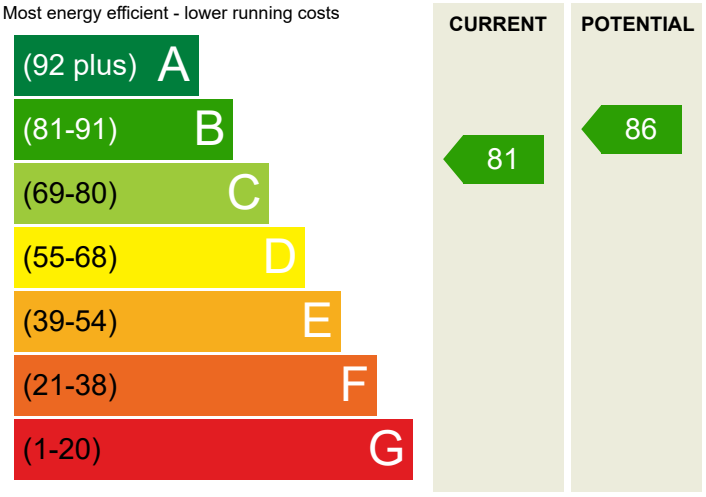
Energy Report

Dwelling Address	19a, Mendelik Road, London, NW2 3RJ
Reference	19A-19a
Assessment Date	02/12/2024
Submission Date	
Property Type	House, Semi-Detached
Total Floor Area	169

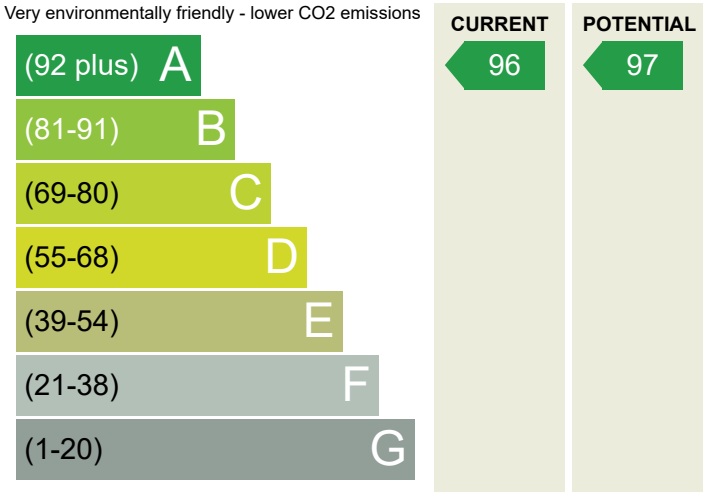
This Energy Report has been generated using the UK's National Calculation Methodology for dwellings, Standard Assessment Procedure (SAP). This methodology is used to assess the energy efficiency of dwellings which is calculated based on a dwelling's heating, hot water, ventilation and lighting usage.

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

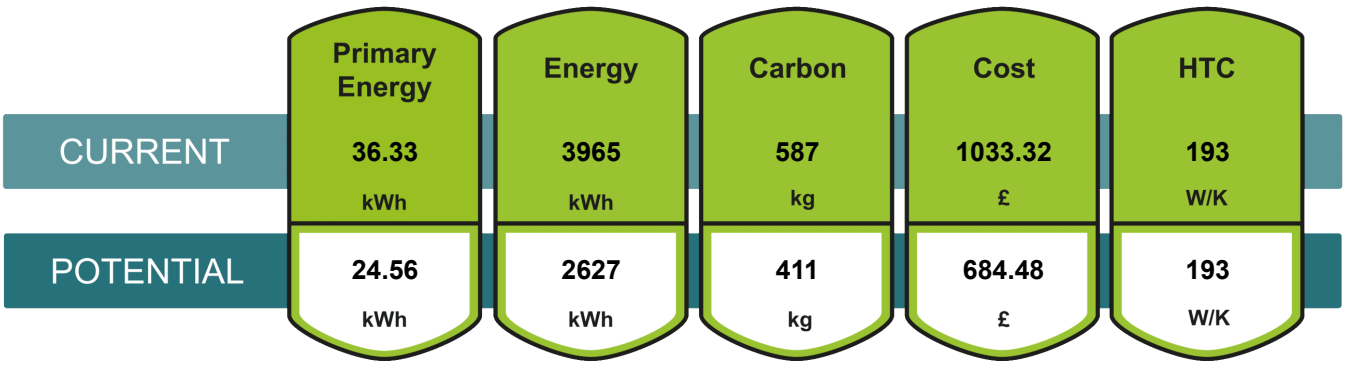
Energy Efficiency Rating



Carbon Dioxide (CO2) Emissions Rating



Additional ratings for your home



Energy Report

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor | Poor | Average | Good | Very Good

Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m²K	Very Good
Roof	Average thermal transmittance 0.13 W/m²K	Very Good
Floor	Average thermal transmittance 0.13 W/m²K	Very Good
Windows	High performance glazing	Very Good
Main heating	Air source heat pump, radiators and underfloor, electric	Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Average
Lighting	Excelent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 5.0 m³/h.m² (assumed)	Good

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling.
To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed.
Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measures	Cumulative savings (per year)	Cumulative rating	Typical costs	Incremental savings (per year)	Cumulative CO2 rating
Solar water heating	£93	B 82	£4,000 - £6,000	£93	A 96
Photovoltaic	£349	B 86	£3,500 - £5,500	£255	A 97

Energy Report

The typical cost is based on average installation prices across the country so may not be representative of the actual costs in your area.

Estimated energy costs of the dwelling

The table below shows the estimated running costs of the space and water heating and lighting within the dwelling. It does not include the energy used from household appliances. The estimated annual costs after potential improvements indicates the total energy cost if all recommended measures named above were installed.

	Estimated annual costs	Estimated annual costs after potential improvements	Potential future savings
Lighting	£85	£85	
Heating	£439	£460	
Hot Water	£510	£395	
New Technologies e.g. Impact of PV	£0	-(£255)	
TOTAL	£1033	£684	

Estimated energy use and potential savings

Space Heating
1684
kWh per year

Water Heating
1955
kWh per year

Energy Report

About this document

Created by:	
Company/Trading name:	
Phone number:	
Email address:	

Disclaimer

This Energy Report should not under any circumstances be treated as a Condition Survey and cannot be used to indicate that any element of the dwelling (e.g.heating system) is working correctly.
This Energy Report must not be used in situations where an Energy Performance Certificate (EPC) is required.
This Energy Report is generated from a set of data inputs which may not reflect the actual dimensions, services or construction of the dwelling.
The calculation used to generate this report reflects the SAP Methodology current at the time of report generation.

Glossary terms for additional metrics

Primary Energy	The measure of the energy required for lighting, heating and hot water in a property. This includes the efficiency of the property's heating system, power station efficiency for electricity and the energy used to produce the fuel and deliver it to the property.
Energy Used	The estimated amount of fuel energy for lighting, heating and hot water for the property. The estimate is based on typical usage which is likely to be different to actual consumption.
Carbon (CO2)	The current emissions based on the energy estimates.
Cost	The estimated cost of energy. The cost of each unit of fuel is based on an industry standard which is likely to be different to those the occupier actually pays.
Heat Transfer Coefficient	Heat flow through the property envelope where internal and external temperatures are different.

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Mon 02 Dec 2024 15:52:53

Project Information			
Assessed By	Darren Coham	Building Type	House, Detached
OCDEA Registration	EES/022007	Assessment Date	2024-12-02

Dwelling Details			
Assessment Type	As designed	Total Floor Area	169 m^2
Site Reference	19b	Plot Reference	19b
Address	19b Mendelik Road, NW2 3RJ		

Client Details	
Name	RT Architectural Consultants
Company	RT
Address	39 Wakemans Hill Avenue, London, NW9 0TA

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.23 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.67 $kgCO_2/m^2$	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*53.63 kWh_{PE}/m^2*	
Dwelling primary energy	38.12 kWh_{PE}/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*44.3 kWh/m^2*	
Dwelling fabric energy efficiency	43.6 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.18	Walls (1) (0.18)	**OK**
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.13	Heatloss Floor 1 (0.13)	**OK**
Roofs	*0.16*	0.13	Roof (2) (0.14)	**OK**
Windows, doors, and roof windows	*1.6*	1.2	ED (1.2)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	146.8215	0.18
Sheltered wall: Walls (2)	43.7	0.17
Exposed wall: Walls (3)	22.4975	0.18
Ground floor: Heatloss Floor 1, Heatloss Floor 1	74.16	0.13
Exposed roof: Roof (1)	33.5	0.11
Exposed roof: Roof (2)	18.97	0.14
Exposed roof: Roof (3)	19.254	0.14

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
ED, half glazed door	3.322	North West	N/A	1.2
w1, windows	5.22	North West	0.75	1.2
fw1, windows	5.22	North West	0.75	1.2
fw2, windows	0.928	North West	0.75	1.2
fw3, windows	0.928	North West	0.75	1.2
rl1, roof windows	0.812	North West	0.75	1.2
rl2, roof windows	0.812	North West	0.75	1.2
rl3, roof windows	0.812	North West	0.75	1.2
bf1, windows	12.166	South East	0.75	1.2
fw4, windows	1.305	South East	0.75	1.2

Name	Area [m^2]	Orientation	Frame factor	U-Value [W/m^2K]
fw5, windows	1.305	South East	0.75	1.2
fw6, windows	1.305	South East	0.75	1.2
sw1, windows	0.8875	South East	0.75	1.2
sw2, windows	0.8875	South East	0.75	1.2
sw3, windows	0.8875	South East	0.75	1.2
w2, windows	0.916	South West	0.75	1.2
w3, windows	0.85875	North East	0.75	1.2
fw7, windows	0.916	South West	0.75	1.2
fw8, windows	0.85875	North East	0.75	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Government-approved scheme	0.236	
External wall	E3: Sill	Government-approved scheme	0.022 **(!)**	
External wall	E4: Jamb	Government-approved scheme	0.017 **(!)**	
External wall	E5: Ground floor (normal)	Government-approved scheme	0.058	
External wall	E6: Intermediate floor within a dwelling	Government-approved scheme	0.001 **(!)**	
External wall	E16: Corner (normal)	Government-approved scheme	0.06	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	
External wall	E10: Eaves (insulation at ceiling level)	Government-approved scheme	0.057	
External wall	E12: Gable (insulation at ceiling level)	Government-approved scheme	0.043	
External wall	E13: Gable (insulation at rafter level)	Government-approved scheme	0.043	
External wall	E11: Eaves (insulation at rafter level)	Government-approved scheme	0.018 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	5.01 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	302.8%
Emitter type	Both radiators and underfloor
Flow temperature	45°C
System type	Heat Pump
Manufacturer	Daikin Europe NV
Model	EBLA14DA3V3
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	200 litres
Declared heat loss	2 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	100 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	19b	**Issued on Date**	02/12/2024
Assessment Reference	19b	**Prop Type Ref**	19b
Property	19b, Mendelik Road, London, NW2 3RJ		

SAP Rating	82 B	**DER**	3.67	**TER**	10.23
Environmental	96 A	**% DER < TER**			64.13
CO_2 Emissions (t/year)	0.55	**DFEE**	43.60	**TFEE**	44.30
Compliance Check	See BREL	**% DFEE < TFEE**			1.59
% DPER < TPER	28.92	**DPER**	38.12	**TPER**	53.63

Assessor Details	Mr. Darren Coham	**Assessor ID**	R789-0001
Client	RT, RT Architectural Consultants		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	74.1600 (1b)	x	2.5500 (2b)	=	189.1080	(1b) - (3b)
First floor	62.7600 (1c)	x	2.8300 (2c)	=	177.6108	(1c) - (3c)
Second floor	32.0600 (1d)	x	2.7500 (2d)	=	88.1650	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	454.8838	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1099	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0100	(17)
Infiltration rate		0.3604	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2793	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3561	0.3492	0.3422	0.3073	0.3003	0.2654	0.2654	0.2584	0.2793	0.3003	0.3142	0.3282	(22b)
Effective ac	0.5634	0.5610	0.5585	0.5472	0.5451	0.5352	0.5352	0.5334	0.5390	0.5451	0.5494	0.5539	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.20)			34.6300	1.1450	39.6527			(27)
half glazed door			3.3200	1.2000	3.9840			(26a)
rl1			0.8100	1.1450	0.9275			(27a)
rl2			0.8100	1.1450	0.9275			(27a)
rl3			0.8100	1.1450	0.9275			(27a)
Heatloss Floor 1			74.1600	0.1300	9.6408	110.0000	8157.6000	(28a)
External Wall 1	182.0696	35.2800	146.7896	0.1800	26.4221	110.0000	16146.8560	(29a)
Wall in roof	43.7000		43.7000	0.1700	7.4290	9.0000	393.3000	(29a)
Dorma Wall	25.1600	2.6700	22.4900	0.1800	4.0482	9.0000	202.4100	(29a)
External Roof	33.5000		33.5000	0.1100	3.6850	9.0000	301.5000	(30)
Green Roof	18.9700		18.9700	0.1400	2.6558	9.0000	170.7300	(30)
Sloped Roof	21.6900	2.4300	19.2600	0.1400	2.6964	9.0000	173.3400	(30)
Total net area of external elements Aum(A, m2)			399.2496					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.9964			(33)
Internal Wall 1			276.5500			9.0000	2488.9500	(32c)
Internal Floor 1			32.0600			18.0000	577.0800	(32d)
Internal Floor 2			62.7600			18.0000	1129.6800	(32d)
Internal Ceiling 1			62.7600			9.0000	564.8400	(32e)

Internal Ceiling 2	32.0600	9.0000	288.5400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 30594.8260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 181.0559 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.4500	0.2360	5.5342
E3 Sill	16.4100	0.0220	0.3610
E4 Jamb	45.7600	0.0170	0.7779
E5 Ground floor (normal)	35.4200	0.0580	2.0544
E6 Intermediate floor within a dwelling	57.4600	0.0010	0.0575
E16 Corner (normal)	32.5200	0.0600	1.9512
R1 Head of roof window	2.4000	0.2400	0.5760
R2 Sill of roof window	2.4000	0.2400	0.5760
R3 Jamb of roof window	6.0900	0.2400	1.4616
E10 Eaves (insulation at ceiling level)	25.8000	0.0570	1.4706
E12 Gable (insulation at ceiling level)	3.7400	0.0430	0.1608
E13 Gable (insulation at rafter level)	5.7000	0.0430	0.2451
E11 Eaves (insulation at rafter level)	11.1000	0.0180	0.1998

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.4261 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 118.4225 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	84.5755	84.2058	83.8435	82.1416	81.8232	80.3409	80.3409	80.0664	80.9118	81.8232	82.4673	83.1408	(38)
Heat transfer coeff	202.9980	202.6284	202.2660	200.5641	200.2457	198.7634	198.7634	198.4889	199.3344	200.2457	200.8899	201.5633	(39)

Average = Sum(39)m / 12 = 200.5626

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2013	1.1991	1.1970	1.1869	1.1850	1.1763	1.1763	1.1746	1.1796	1.1850	1.1888	1.1928	(40)
HLP (average)												1.1869	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9612 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

85.2165	83.9509	82.1687	78.8826	76.4220	73.6937	72.2199	73.9897	75.9166	78.8361	82.1898	84.9284	(42b)

Hot water usage for other uses

44.9557	43.3210	41.6862	40.0514	38.4167	36.7819	36.7819	38.4167	40.0514	41.6862	43.3210	44.9557	(42c)

Average daily hot water use (litres/day) 119.8779 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.1722	127.2718	123.8549	118.9341	114.8387	110.4756	109.0019	112.4064	115.9680	120.5223	125.5107	129.8841	(44)
Energy conte	206.1609	181.2334	190.3603	162.8148	154.5950	135.8426	131.8283	139.1826	143.0002	163.5476	178.8131	203.3671	(45)

Energy content (annual) Total = Sum(45)m = 1990.7459

Distribution loss (46)m = 0.15 x (45)m												
30.9241	27.1850	28.5541	24.4222	23.1893	20.3764	19.7742	20.8774	21.4500	24.5321	26.8220	30.5051	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.0000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0800 (55)
Total storage loss

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)

If cylinder contains dedicated solar storage

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

262.9033	232.4846	247.1027	217.7268	211.3374	190.7546	188.5707	195.9250	197.9122	220.2900	233.7251	260.1095	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

262.9033	232.4846	247.1027	217.7268	211.3374	190.7546	188.5707	195.9250	197.9122	220.2900	233.7251	260.1095	(64)

Total per year (kWh/year) = Sum(64)m = 2658.8419 (64)
12Total per year (kWh/year) 2659 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

113.9424	101.2611	108.6887	98.0655	96.7968	89.0973	89.2268	91.6721	91.4772	99.7735	103.3849	113.0135	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	171.7472	190.1487	171.7472	177.4721	171.7472	177.4721	171.7472	171.7472	177.4721	171.7472	177.4721	171.7472	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.5080	344.0414	335.1373	316.1816	292.2534	269.7643	254.7402	251.2068	260.1109	279.0666	302.9948	325.4839	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	(71)
Water heating gains (Table 5)	153.1484	150.6861	146.0870	136.2021	130.1032	123.7462	119.9285	123.2152	127.0516	134.1041	143.5902	151.8998	(72)
Total internal gains	732.8217	752.2943	720.3896	697.2739	661.5219	638.4007	613.8340	613.5873	632.0526	652.3360	691.4751	716.5490	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.7200	11.2829	0.6300	0.7500	0.7700	6.3546	(75)
Southeast	18.7700	36.7938	0.6300	0.7500	0.7700	226.1384	(77)
Southwest	1.8400	36.7938	0.6300	0.7500	0.7700	22.1681	(79)
Northwest	12.3000	11.2829	0.6300	0.7500	0.7700	45.4425	(81)
Northwest	2.4300	16.3666	0.6300	0.7500	1.0000	16.9125	(82)

Solar gains	317.0161	563.2006	832.8698	1137.3890	1370.9497	1403.8950	1335.6537	1154.7213	937.2024	639.1858	383.9226	268.5837	(83)
Total gains	1049.8378	1315.4949	1553.2595	1834.6629	2032.4716	2042.2957	1949.4877	1768.3085	1569.2551	1291.5218	1075.3977	985.1327	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.8653	41.9416	42.0168	42.3733	42.4407	42.7572	42.7572	42.8163	42.6347	42.4407	42.3046	42.1632	
alpha	3.7910	3.7961	3.8011	3.8249	3.8294	3.8505	3.8505	3.8544	3.8423	3.8294	3.8203	3.8109	
util living area	0.9919	0.9808	0.9559	0.8870	0.7569	0.5807	0.4371	0.4960	0.7382	0.9323	0.9838	0.9936	(86)
Living	19.5065	19.7324	20.0473	20.4370	20.7240	20.8678	20.9063	20.8982	20.7886	20.3893	19.8734	19.4687	
Non living	18.1701	18.4582	18.8552	19.3354	19.6586	19.8030	19.8308	19.8281	19.7367	19.2914	18.6459	18.1270	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2360	19.7324	20.0473	20.4370	20.7240	20.8678	20.9063	20.8982	20.7886	20.3893	19.8734	19.6829	(87)
Th 2	19.9189	19.9207	19.9224	19.9305	19.9320	19.9390	19.9390	19.9404	19.9363	19.9320	19.9289	19.9257	(88)
util rest of house	0.9898	0.9761	0.9450	0.8597	0.7030	0.4987	0.3369	0.3905	0.6620	0.9098	0.9790	0.9920	(89)
MIT 2	19.2217	18.4582	18.8552	19.3354	19.6586	19.8030	19.8308	19.8281	19.7367	19.2914	18.6459	18.4511	(90)
Living area fraction									fLA = Living area / (4) =			0.3255	(91)
MIT	19.5519	18.8729	19.2432	19.6940	20.0054	20.1496	20.1809	20.1764	20.0791	19.6488	19.0454	18.8521	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5519	18.8729	19.2432	19.6940	20.0054	20.1496	20.1809	20.1764	20.0791	19.6488	19.0454	18.8521	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9890	0.9701	0.9365	0.8527	0.7071	0.5157	0.3603	0.4148	0.6733	0.9024	0.9737	0.9898	(94)
Useful gains	1038.2739	1276.1249	1454.5588	1564.5020	1437.0997	1053.2077	702.3403	733.5293	1056.5240	1165.5203	1047.1592	975.0778	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	3096.0960	2831.3119	2577.5213	2164.8853	1663.1165	1103.0529	711.7455	749.5766	1191.8415	1811.9750	2399.7147	2953.3198	(97)
Space heating kWh	1531.0197	1045.0857	835.4841	432.2759	168.1565	0.0000	0.0000	0.0000	0.0000	480.9623	973.8399	1471.8120	(98a)
Space heating requirement - total per year (kWh/year)												6938.6361	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1531.0197	1045.0857	835.4841	432.2759	168.1565	0.0000	0.0000	0.0000	0.0000	480.9623	973.8399	1471.8120	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6938.6361	
Space heating per m2											(98c) / (4) =	41.0619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	302.8452	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1531.0197	1045.0857	835.4841	432.2759	168.1565	0.0000	0.0000	0.0000	0.0000	480.9623	973.8399	1471.8120	(98)
Space heating efficiency (main heating system 1)	302.8452	302.8452	302.8452	302.8452	302.8452	0.0000	0.0000	0.0000	0.0000	302.8452	302.8452	302.8452	(210)
Space heating fuel (main heating system)	505.5453	345.0890	275.8782	142.7382	55.5256	0.0000	0.0000	0.0000	0.0000	158.8146	321.5636	485.9948	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.9033	232.4846	247.1027	217.7268	211.3374	190.7546	188.5707	195.9250	197.9122	220.2900	233.7251	260.1095	(64)
Efficiency of water heater												173.5813	(216)
(217)m	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	(217)
Fuel for water heating, kWh/month	151.4583	133.9341	142.3556	125.4322	121.7512	109.8935	108.6354	112.8721	114.0170	126.9088	134.6487	149.8488	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	40.3780	32.3927	29.1660	21.3683	16.5055	13.4851	15.0569	19.5715	25.4214	33.3543	37.6736	41.5002	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2291.1493	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	173.5813	
Water heating fuel used	1531.7558	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	325.8734	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4148.7785	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2291.1493	0.1558	356.9405	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1531.7558	0.1408	215.7199	(264)
Space and water heating			572.6604	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	325.8734	0.1443	47.0336	(268)
Total CO2, kg/year			619.6940	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2291.1493	1.5767	3612.5323	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1531.7558	1.5207	2329.4046	(278)
Space and water heating			5941.9368	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	325.8734	1.5338	499.8356	(282)
Total Primary energy kWh/year			6441.7724	(286)
Dwelling Primary energy Rate (DPER)			38.1200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	74.1600 (1b)	x	2.5500 (2b)	=	189.1080	(1b) - (3b)
First floor	62.7600 (1c)	x	2.8300 (2c)	=	177.6108	(1c) - (3c)
Second floor	32.0600 (1d)	x	2.7500 (2d)	=	88.1650	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	454.8838	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0879	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3379	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2619	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3339	0.3274	0.3208	0.2881	0.2815	0.2488	0.2488	0.2423	0.2619	0.2815	0.2946	0.3077	(22b)
Effective ac	0.5558	0.5536	0.5515	0.5415	0.5396	0.5310	0.5310	0.5293	0.5343	0.5396	0.5434	0.5473	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			3.3200	1.0000	3.3200			(26a)
TER Opening Type (Uw = 1.20)			34.6300	1.1450	39.6527			(27)
rl1			0.8100	1.4151	1.1462			(27a)
rl2			0.8100	1.4151	1.1462			(27a)
rl3			0.8100	1.4151	1.1462			(27a)
Heatloss Floor 1			74.1600	0.1300	9.6408			(28a)
External Wall 1	182.0696	35.2800	146.7896	0.1800	26.4221			(29a)
Wall in roof	43.7000		43.7000	0.1800	7.8660			(29a)
Dorma Wall	25.1600	2.6700	22.4900	0.1800	4.0482			(29a)
External Roof	33.5000		33.5000	0.1100	3.6850			(30)
Green Roof	18.9700		18.9700	0.1100	2.0867			(30)
Sloped Roof	21.6900	2.4300	19.2600	0.1100	2.1186			(30)
Total net area of external elements Aum(A, m2)			399.2496					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.2788			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 181.0559 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.4500	0.0500	1.1725
E3 Sill	16.4100	0.0500	0.8205
E4 Jamb	45.7600	0.0500	2.2880
E5 Ground floor (normal)	35.4200	0.1600	5.6672
E6 Intermediate floor within a dwelling	57.4600	0.0000	0.0000
E16 Corner (normal)	32.5200	0.0900	2.9268
R1 Head of roof window	2.4000	0.0800	0.1920
R2 Sill of roof window	2.4000	0.0600	0.1440
R3 Jamb of roof window	6.0900	0.0800	0.4872
E10 Eaves (insulation at ceiling level)	25.8000	0.0600	1.5480
E12 Gable (insulation at ceiling level)	3.7400	0.0600	0.2244
E13 Gable (insulation at rafter level)	5.7000	0.0800	0.4560
E11 Eaves (insulation at rafter level)	11.1000	0.0400	0.4440

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.3706 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 118.6494 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	83.4248	83.0998	82.7813	81.2851	81.0052	79.7021	79.7021	79.4607	80.2040	81.0052	81.5715	82.1635	(38)
Heat transfer coeff	202.0742	201.7492	201.4307	199.9345	199.6546	198.3514	198.3514	198.1101	198.8534	199.6546	200.2209	200.8129	(39)
Average = Sum(39)m / 12 =												199.9332	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1958	1.1939	1.1920	1.1832	1.1815	1.1738	1.1738	1.1724	1.1768	1.1815	1.1849	1.1884	(40)
HLP (average)												1.1832	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9612 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	85.2165	83.9509	82.1687	78.8826	76.4220	73.6937	72.2199	73.9897	75.9166	78.8361	82.1898	84.9284	(42b)
Hot water usage for other uses													
	44.9557	43.3210	41.6862	40.0514	38.4167	36.7819	36.7819	38.4167	40.0514	41.6862	43.3210	44.9557	(42c)
Average daily hot water use (litres/day)												119.8779	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	130.1722	127.2718	123.8549	118.9341	114.8387	110.4756	109.0019	112.4064	115.9680	120.5223	125.5107	129.8841	(44)
Energy conte	206.1609	181.2334	190.3603	162.8148	154.5950	135.8426	131.8283	139.1826	143.0002	163.5476	178.8131	203.3671	(45)
Energy content (annual)										Total = Sum(45)m =		1990.7459	
Distribution loss (46)m = 0.15 x (45)m													
	30.9241	27.1850	28.5541	24.4222	23.1893	20.3764	19.7742	20.8774	21.4500	24.5321	26.8220	30.5051	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	257.0870	227.2312	241.2864	212.0981	205.5211	185.1259	182.7544	190.1086	192.2835	214.4736	228.0964	254.2932	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	257.0870	227.2312	241.2864	212.0981	205.5211	185.1259	182.7544	190.1086	192.2835	214.4736	228.0964	254.2932	(64)
										Total per year (kWh/year) = Sum(64)m =		2590.3593	(64)
12Total per year (kWh/year)												2590	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	109.2894	97.0583	104.0357	93.5626	92.1437	84.5943	84.5738	87.0191	86.9742	95.1204	98.8820	108.3604	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	171.7585	190.1612	171.7585	177.4838	171.7585	177.4838	171.7585	171.7585	177.4838	171.7585	177.4838	171.7585	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	340.5080	344.0414	335.1373	316.1816	292.2534	269.7643	254.7402	251.2068	260.1109	279.0666	302.9948	325.4839	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	(71)
Water heating gains (Table 5)													
	146.8943	144.4320	139.8329	129.9480	123.8491	117.4921	113.6744	116.9611	120.7975	127.8500	137.3361	145.6457	(72)
Total internal gains													
	729.5789	749.0527	717.1468	694.0315	658.2791	632.1583	607.5912	607.3445	625.8102	649.0932	688.2327	713.3062	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.7200	11.2829	0.6300	0.7000	0.7700	5.9309	(75)
Southeast	18.7700	36.7938	0.6300	0.7000	0.7700	211.0625	(77)
Southwest	1.8400	36.7938	0.6300	0.7000	0.7700	20.6902	(79)
Northwest	12.3000	11.2829	0.6300	0.7000	0.7700	42.4130	(81)
Northwest	2.4300	16.3666	0.6300	0.7000	1.0000	15.7850	(82)

Solar gains	295.8817	525.6539	777.3452	1061.5631	1279.5531	1310.3020	1246.6101	1077.7399	874.7223	596.5734	358.3278	250.6781	(83)
Total gains	1025.4606	1274.7066	1494.4920	1755.5945	1937.8321	1942.4603	1854.2013	1685.0843	1500.5325	1245.6666	1046.5605	963.9843	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.0566	42.1244	42.1910	42.5067	42.5663	42.8460	42.8460	42.8982	42.7378	42.5663	42.4459	42.3208	
alpha	3.8038	3.8083	3.8127	3.8338	3.8378	3.8564	3.8564	3.8599	3.8492	3.8378	3.8297	3.8214	
util living area													
	0.9925	0.9826	0.9605	0.8981	0.7760	0.6033	0.4567	0.5164	0.7569	0.9385	0.9851	0.9940	(86)
MIT	19.1082	19.3974	19.8067	20.3218	20.7157	20.9212	20.9791	20.9668	20.8094	20.2693	19.5901	19.0579	(87)
Th 2	19.9233	19.9249	19.9264	19.9335	19.9348	19.9410	19.9410	19.9422	19.9386	19.9348	19.9321	19.9293	(88)
util rest of house													
	0.9906	0.9783	0.9505	0.8727	0.7237	0.5201	0.3530	0.4081	0.6821	0.9176	0.9807	0.9925	(89)
MIT 2	17.7179	18.0863	18.6028	19.2374	19.6850	19.8902	19.9326	19.9275	19.7964	19.1901	18.3390	17.6575	(90)
Living area fraction									fLA = Living area / (4) =			0.3255	(91)
MIT	18.1704	18.5131	18.9947	19.5904	20.0205	20.2258	20.2732	20.2658	20.1261	19.5413	18.7462	18.1133	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1704	18.5131	18.9947	19.5904	20.0205	20.2258	20.2732	20.2658	20.1261	19.5413	18.7462	18.1133	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9860	0.9705	0.9394	0.8631	0.7283	0.5435	0.3864	0.4424	0.6967	0.9079	0.9738	0.9887	(94)
Useful gains	1011.1537	1237.0433	1403.9057	1515.2820	1411.2638	1055.8125	716.3993	745.5059	1045.3722	1130.9309	1019.1609	953.0998	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2802.8526	2746.4257	2516.8100	2137.3776	1661.2162	1115.8815	728.5877	765.8551	1198.3091	1785.1783	2331.8141	2793.9755	(97)
Space heating kWh													
	1333.0240	1014.3050	828.0008	447.9088	185.9646	0.0000	0.0000	0.0000	0.0000	486.7601	945.1103	1369.6115	(98a)
Space heating requirement - total per year (kWh/year)												6610.6852	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1333.0240	1014.3050	828.0008	447.9088	185.9646	0.0000	0.0000	0.0000	0.0000	486.7601	945.1103	1369.6115	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6610.6852	
Space heating per m2											(98c) / (4) =	39.1211	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1333.0240	1014.3050	828.0008	447.9088	185.9646	0.0000	0.0000	0.0000	0.0000	486.7601	945.1103	1369.6115	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	1444.2297	1098.9220	897.0757	485.2750	201.4784	0.0000	0.0000	0.0000	0.0000	527.3674	1023.9548	1483.8695	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	257.0870	227.2312	241.2864	212.0981	205.5211	185.1259	182.7544	190.1086	192.2835	214.4736	228.0964	254.2932	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.2098	87.0041	86.5962	85.6942	83.8362	79.8000	79.8000	79.8000	79.8000	85.8390	86.8946	87.2589	(217)
Fuel for water heating, kWh/month													
	294.7915	261.1730	278.6340	247.5059	245.1459	231.9874	229.0155	238.2314	240.9567	249.8556	262.4976	291.4237	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	35.6880	28.6303	25.7784	18.8863	14.5884	11.9188	13.3080	17.2982	22.4687	29.4801	33.2977	36.6799	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-65.6917	-90.7892	-127.9202	-140.8147	-149.2314	-138.2105	-136.3183	-129.8362	-118.2001	-102.1865	-71.4925	-56.9947	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-42.8931	-89.4971	-176.6097	-263.5079	-346.8504	-348.0813	-344.1560	-292.2662	-215.2666	-127.6114	-57.1273	-33.9907	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	7162.1724	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3071.2182	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	288.0228	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3665.5438	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6941.8696	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7162.1724	0.2100	1504.0562	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3071.2182	0.2100	644.9558	(264)
Space and water heating			2149.0120	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	288.0228	0.1443	41.5706	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1327.6860	0.1350	-179.3024	
PV Unit electricity exported	-2337.8578	0.1261	-294.7587	
Total			-474.0611	(269)
Total CO2, kg/year			1728.4508	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.2300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	7162.1724	1.1300	8093.2549	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3071.2182	1.1300	3470.4766	(278)
Space and water heating			11563.7314	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	288.0228	1.5338	441.7790	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1327.6860	1.4991	-1990.3916	
PV Unit electricity exported	-2337.8578	0.4628	-1081.9846	
Total			-3072.3763	(283)
Total Primary energy kWh/year			9063.2349	(286)
Target Primary Energy Rate (TPER)			53.6300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)

Ground floor	74.1600 (1b)	x	2.5500 (2b)	=	189.1080 (1b) - (3b)
First floor	62.7600 (1c)	x	2.8300 (2c)	=	177.6108 (1c) - (3c)
Second floor	32.0600 (1d)	x	2.7500 (2d)	=	88.1650 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.9800				(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	454.8838 (5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80	=	0.0000 (6a)
Number of open flues	0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20	=	0.0000 (6d)
Number of flues attached to other heater	0 * 35	=	0.0000 (6e)
Number of blocked chimneys	0 * 20	=	0.0000 (6f)
Number of intermittent extract fans	4 * 10	=	40.0000 (7a)
Number of passive vents	0 * 10	=	0.0000 (7b)
Number of flueless gas fires	0 * 40	=	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5)	=	0.0879 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0100 (17)
Infiltration rate			0.3384 (18)
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.2623 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3344	0.3279	0.3213	0.2885	0.2820	0.2492	0.2492	0.2426	0.2623	0.2820	0.2951	0.3082	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000 (23c)

Effective ac	0.5559	0.5537	0.5516	0.5416	0.5398	0.5310	0.5310	0.5294	0.5344	0.5398	0.5435	0.5475	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.20)			34.6300	1.1450	39.6527			(27)
half glazed door			3.3200	1.2000	3.9840			(26a)
rl1			0.8100	1.1450	0.9275			(27a)
rl2			0.8100	1.1450	0.9275			(27a)
rl3			0.8100	1.1450	0.9275			(27a)
Heatloss Floor 1			74.1600	0.1300	9.6408	110.0000	8157.6000	(28a)
External Wall 1	182.0696	35.2800	146.7896	0.1800	26.4221	110.0000	16146.8560	(29a)
Wall in roof	43.7000		43.7000	0.1700	7.4290	9.0000	393.3000	(29a)
Dorma Wall	25.1600	2.6700	22.4900	0.1800	4.0482	9.0000	202.4100	(29a)
External Roof	33.5000		33.5000	0.1100	3.6850	9.0000	301.5000	(30)
Green Roof	18.9700		18.9700	0.1400	2.6558	9.0000	170.7300	(30)
Sloped Roof	21.6900	2.4300	19.2600	0.1400	2.6964	9.0000	173.3400	(30)
Total net area of external elements Aum(A, m2)			399.2496					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.9964			(33)
Internal Wall 1			276.5500			9.0000	2488.9500	(32c)
Internal Floor 1			32.0600			18.0000	577.0800	(32d)
Internal Floor 2			62.7600			18.0000	1129.6800	(32d)
Internal Ceiling 1			62.7600			9.0000	564.8400	(32e)
Internal Ceiling 2			32.0600			9.0000	288.5400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e)	=	30594.8260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			181.0559 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.4500	0.2360	5.5342
E3 Sill	16.4100	0.0220	0.3610
E4 Jamb	45.7600	0.0170	0.7779
E5 Ground floor (normal)	35.4200	0.0580	2.0544
E6 Intermediate floor within a dwelling	57.4600	0.0010	0.0575
E16 Corner (normal)	32.5200	0.0600	1.9512
R1 Head of roof window	2.4000	0.2400	0.5760
R2 Sill of roof window	2.4000	0.2400	0.5760
R3 Jamb of roof window	6.0900	0.2400	1.4616
E10 Eaves (insulation at ceiling level)	25.8000	0.0570	1.4706
E12 Gable (insulation at ceiling level)	3.7400	0.0430	0.1608
E13 Gable (insulation at rafter level)	5.7000	0.0430	0.2451
E11 Eaves (insulation at rafter level)	11.1000	0.0180	0.1998

Thermal bridges (Sum(L x Psi) calculated using Appendix K)			15.4261 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a)	=	118.4225 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	83.4496	83.1237	82.8042	81.3036	81.0228	79.7158	79.7158	79.4738	80.2192	81.0228	81.5908	82.1846	(38)
Heat transfer coeff	201.8721	201.5462	201.2267	199.7261	199.4453	198.1383	198.1383	197.8963	198.6418	199.4453	200.0133	200.6071	(39)
Average = Sum(39)m / 12 =												199.7247	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1947	1.1927	1.1908	1.1820	1.1803	1.1726	1.1726	1.1711	1.1755	1.1803	1.1837	1.1872	(40)
HLP (average)												1.1819	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9612 (42)

Hot water usage for mixer showers

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)

Hot water usage for baths

	31.8895	31.4159	30.7490	29.5193	28.5985	27.5775	27.0260	27.6883	28.4094	29.5019	30.7569	31.7817 (42b)

Hot water usage for other uses

	44.9557	43.3210	41.6862	40.0514	38.4167	36.7819	36.7819	38.4167	40.0514	41.6862	43.3210	44.9557 (42c)

Average daily hot water use (litres/day) 70.4355 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.8452	74.7369	72.4352	69.5707	67.0152	64.3594	63.8079	66.1050	68.4608	71.1881	74.0779	76.7374	(44)
Energy conte	121.7041	106.4243	111.3302	95.2389	90.2153	79.1374	77.1702	81.8517	84.4190	96.6015	105.5375	120.1523	(45)

Energy content (annual) Total = Sum(45)m = 1169.7825

Distribution loss (46)m = 0.15 x (45)m

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

Water storage loss:

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	103.4485	90.4607	94.6307	80.9530	76.6830	67.2668	65.5946	69.5740	71.7562	82.1113	89.7069	102.1294 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	103.4485	90.4607	94.6307	80.9530	76.6830	67.2668	65.5946	69.5740	71.7562	82.1113	89.7069	102.1294 (64)

Total per year (kWh/year) = Sum(64)m = 994.3151 (64)

12Total per year (kWh/year) 994 (64)

Electric shower(s)

	59.1572	52.7095	57.5568	54.9257	55.9564	53.3770	55.1562	55.9564	54.9257	57.5568	56.4745	59.1572 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 672.9095 (64a)

Heat gains from water heating, kWh/month

	40.6514	35.7926	38.0469	33.9697	33.1599	30.1610	30.1877	31.3826	31.6705	34.9170	36.5453	40.3217 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	171.7472	190.1487	171.7472	177.4721	171.7472	177.4721	171.7472	171.7472	177.4721	171.7472	177.4721	171.7472	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	340.5080	344.0414	335.1373	316.1816	292.2534	269.7643	254.7402	251.2068	260.1109	279.0666	302.9948	325.4839	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	(71)
Water heating gains (Table 5)													
	54.6390	53.2627	51.1383	47.1801	44.5697	41.8902	40.5749	42.1809	43.9868	46.9315	50.7574	54.1958	(72)
Total internal gains													
	634.3123	654.8709	625.4409	608.2519	575.9884	556.5447	534.4803	532.5530	548.9878	565.1633	598.6423	618.8449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.7200	11.2829	0.6300	0.7500	0.7700	6.3546	(75)
Southeast	18.7700	36.7938	0.6300	0.7500	0.7700	226.1384	(77)
Southwest	1.8400	36.7938	0.6300	0.7500	0.7700	22.1681	(79)
Northwest	12.3000	11.2829	0.6300	0.7500	0.7700	45.4425	(81)
Northwest	2.4300	16.3666	0.6300	0.7500	1.0000	16.9125	(82)

Solar gains	317.0161	563.2006	832.8698	1137.3890	1370.9497	1403.8950	1335.6537	1154.7213	937.2024	639.1858	383.9226	268.5837	(83)
Total gains	951.3284	1218.0715	1458.3107	1745.6409	1946.9381	1960.4397	1870.1340	1687.2742	1486.1902	1204.3491	982.5650	887.4286	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.0987	42.1668	42.2338	42.5511	42.6110	42.8921	42.8921	42.9445	42.7834	42.6110	42.4900	42.3642	
alpha	3.8066	3.8111	3.8156	3.8367	3.8407	3.8595	3.8595	3.8630	3.8522	3.8407	3.8327	3.8243	
util living area													
	0.9942	0.9849	0.9632	0.8994	0.7738	0.5985	0.4528	0.5154	0.7606	0.9440	0.9879	0.9955	(86)
MIT	19.0526	19.3572	19.7841	20.3183	20.7194	20.9235	20.9798	20.9672	20.8063	20.2449	19.5435	19.0000	(87)
Th 2	19.9243	19.9258	19.9273	19.9345	19.9358	19.9420	19.9420	19.9432	19.9396	19.9358	19.9331	19.9303	(88)
util rest of house													
	0.9927	0.9812	0.9539	0.8743	0.7213	0.5157	0.3499	0.4073	0.6862	0.9246	0.9843	0.9944	(89)
MIT 2	18.1501	18.4533	18.8739	19.3887	19.7438	19.9037	19.9357	19.9319	19.8266	19.3329	18.6455	18.1020	(90)
Living area fraction										fLA = Living area / (4) =		0.3255	(91)
MIT	18.4439	18.7475	19.1702	19.6913	20.0613	20.2356	20.2755	20.2689	20.1455	19.6297	18.9378	18.3943	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4439	18.7475	19.1702	19.6913	20.0613	20.2356	20.2755	20.2689	20.1455	19.6297	18.9378	18.3943	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9898	0.9756	0.9455	0.8676	0.7280	0.5397	0.3831	0.4418	0.7021	0.9176	0.9796	0.9920	(94)

Useful gains	941.6096	1188.3927	1378.8584	1514.4764	1417.3926	1058.0855	716.4665	745.4397	1043.5279	1105.1318	962.5289	880.3300	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2855.2519	2790.9114	2549.5732	2155.3009	1667.6298	1116.6339	728.2620	765.6312	1200.8864	1800.9388	2367.7114	2847.4754	(97)
Space heating kWh													
	1423.7499	1076.8926	871.0118	461.3936	186.1765	0.0000	0.0000	0.0000	0.0000	517.6804	1011.7314	1463.5562	(98a)
Space heating requirement - total per year (kWh/year)												7012.1925	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1423.7499	1076.8926	871.0118	461.3936	186.1765	0.0000	0.0000	0.0000	0.0000	517.6804	1011.7314	1463.5562	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7012.1925	
Space heating per m2											(98c) / (4) =	41.4972	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1862.5003	1466.2237	1504.0119	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8529	0.9073	0.8729	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1588.5062	1330.2555	1312.9021	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2188.4941	2088.0218	1883.1262	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	431.9913	563.7782	424.2467	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	107.9978	140.9445	106.0617	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												355.0041	(107)
Energy for space heating												41.4972	(99)
Energy for space cooling												2.1009	(108)
Total												43.5980	(109)
Fabric Energy Efficiency (DFEE)												43.6	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	74.1600 (1b)	x	2.5500 (2b)	=	189.1080	(1b) - (3b)
First floor	62.7600 (1c)	x	2.8300 (2c)	=	177.6108	(1c) - (3c)
Second floor	32.0600 (1d)	x	2.7500 (2d)	=	88.1650	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	454.8838	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0879	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3379	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2619	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3339	0.3274	0.3208	0.2881	0.2815	0.2488	0.2488	0.2423	0.2619	0.2815	0.2946	0.3077	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5558	0.5536	0.5515	0.5415	0.5396	0.5310	0.5310	0.5293	0.5343	0.5396	0.5434	0.5473	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Semi-glazed door			3.3200	1.0000	3.3200			(26a)
TER Opening Type (Uw = 1.20)			34.6300	1.1450	39.6527			(27)
rl1			0.8100	1.4151	1.1462			(27a)
rl2			0.8100	1.4151	1.1462			(27a)
rl3			0.8100	1.4151	1.1462			(27a)
Heatloss Floor 1			74.1600	0.1300	9.6408			(28a)
External Wall 1	182.0696	35.2800	146.7896	0.1800	26.4221			(29a)
Wall in roof	43.7000		43.7000	0.1800	7.8660			(29a)
Dorma Wall	25.1600	2.6700	22.4900	0.1800	4.0482			(29a)
External Roof	33.5000		33.5000	0.1100	3.6850			(30)
Green Roof	18.9700		18.9700	0.1100	2.0867			(30)
Sloped Roof	21.6900	2.4300	19.2600	0.1100	2.1186			(30)
Total net area of external elements Aum(A, m2)			399.2496					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.2788			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 181.0559 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.4500	0.0500	1.1725
E3 Sill	16.4100	0.0500	0.8205
E4 Jamb	45.7600	0.0500	2.2880
E5 Ground floor (normal)	35.4200	0.1600	5.6672
E6 Intermediate floor within a dwelling	57.4600	0.0000	0.0000
E16 Corner (normal)	32.5200	0.0900	2.9268
R1 Head of roof window	2.4000	0.0800	0.1920
R2 Sill of roof window	2.4000	0.0600	0.1440
R3 Jamb of roof window	6.0900	0.0800	0.4872
E10 Eaves (insulation at ceiling level)	25.8000	0.0600	1.5480
E12 Gable (insulation at ceiling level)	3.7400	0.0600	0.2244
E13 Gable (insulation at rafter level)	5.7000	0.0800	0.4560
E11 Eaves (insulation at rafter level)	11.1000	0.0400	0.4440

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.3706 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 118.6494 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	83.4248	83.0998	82.7813	81.2851	81.0052	79.7021	79.7021	79.4607	80.2040	81.0052	81.5715	82.1635	(38)
Heat transfer coeff	202.0742	201.7492	201.4307	199.9345	199.6546	198.3514	198.3514	198.1101	198.8534	199.6546	200.2209	200.8129	(39)
Average = Sum(39)m / 12 =												199.9332	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1958	1.1939	1.1920	1.1832	1.1815	1.1738	1.1738	1.1724	1.1768	1.1815	1.1849	1.1884	(40)
HLP (average)												1.1832	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9612 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.8895	31.4159	30.7490	29.5193	28.5985	27.5775	27.0260	27.6883	28.4094	29.5019	30.7569	31.7817	(42b)

Hot water usage for other uses

44.9557	43.3210	41.6862	40.0514	38.4167	36.7819	36.7819	38.4167	40.0514	41.6862	43.3210	44.9557	(42c)

Average daily hot water use (litres/day) 70.4355 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.8452	74.7369	72.4352	69.5707	67.0152	64.3594	63.8079	66.1050	68.4608	71.1881	74.0779	76.7374	(44)
Energy conte	121.7041	106.4243	111.3302	95.2389	90.2153	79.1374	77.1702	81.8517	84.4190	96.6015	105.5375	120.1523	(45)
Energy content (annual)										Total = Sum(45)m =		1169.7825	

Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

103.4485	90.4607	94.6307	80.9530	76.6830	67.2668	65.5946	69.5740	71.7562	82.1113	89.7069	102.1294	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

103.4485	90.4607	94.6307	80.9530	76.6830	67.2668	65.5946	69.5740	71.7562	82.1113	89.7069	102.1294	(64)

Total per year (kWh/year) = Sum(64)m = 994.3151 (64)

12Total per year (kWh/year) 994 (64)

Electric shower(s)

59.1572	52.7095	57.5568	54.9257	55.9564	53.3770	55.1562	55.9564	54.9257	57.5568	56.4745	59.1572	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 672.9095 (64a)

Heat gains from water heating, kWh/month

40.6514	35.7926	38.0469	33.9697	33.1599	30.1610	30.1877	31.3826	31.6705	34.9170	36.5453	40.3217	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	148.0603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	171.7585	190.1612	171.7585	177.4838	171.7585	177.4838	171.7585	171.7585	177.4838	171.7585	177.4838	171.7585	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.5080	344.0414	335.1373	316.1816	292.2534	269.7643	254.7402	251.2068	260.1109	279.0666	302.9948	325.4839	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	37.8060	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	(71)
Water heating gains (Table 5)	54.6390	53.2627	51.1383	47.1801	44.5697	41.8902	40.5749	42.1809	43.9868	46.9315	50.7574	54.1958	(72)

Total internal gains

	634.3236	654.8834	625.4522	608.2636	575.9997	556.5564	534.4917	532.5643	548.9995	565.1746	598.6540	618.8562 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.7200	11.2829	0.6300	0.7000	0.7700	5.9309	(75)
Southeast	18.7700	36.7938	0.6300	0.7000	0.7700	211.0625	(77)
Southwest	1.8400	36.7938	0.6300	0.7000	0.7700	20.6902	(79)
Northwest	12.3000	11.2829	0.6300	0.7000	0.7700	42.4130	(81)
Northwest	2.4300	16.3666	0.6300	0.7000	1.0000	15.7850	(82)

Solar gains	295.8817	525.6539	777.3452	1061.5631	1279.5531	1310.3020	1246.6101	1077.7399	874.7223	596.5734	358.3278	250.6781	(83)
Total gains	930.2053	1180.5373	1402.7974	1669.8267	1855.5528	1866.8584	1781.1018	1610.3042	1423.7218	1161.7480	956.9818	869.5343	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.0566	42.1244	42.1910	42.5067	42.5663	42.8460	42.8460	42.8982	42.7378	42.5663	42.4459	42.3208	
alpha	3.8038	3.8083	3.8127	3.8338	3.8378	3.8564	3.8564	3.8599	3.8492	3.8378	3.8297	3.8214	
util living area	0.9946	0.9864	0.9673	0.9103	0.7936	0.6219	0.4735	0.5368	0.7789	0.9495	0.9889	0.9958	(86)
MIT	19.0339	19.3268	19.7437	20.2761	20.6905	20.9125	20.9763	20.9622	20.7878	20.2162	19.5220	18.9836	(87)
Th 2	19.9233	19.9249	19.9264	19.9335	19.9348	19.9410	19.9410	19.9422	19.9386	19.9348	19.9321	19.9293	(88)
util rest of house	0.9932	0.9830	0.9589	0.8870	0.7428	0.5380	0.3669	0.4256	0.7062	0.9317	0.9856	0.9947	(89)
MIT 2	18.1308	18.4226	18.8343	19.3500	19.7208	19.8966	19.9335	19.9290	19.8132	19.3055	18.6236	18.0851	(90)
Living area fraction									fLA = Living area / (4) =			0.3255	(91)
MIT	18.4248	18.7169	19.1303	19.6514	20.0364	20.2272	20.2729	20.2653	20.1304	19.6019	18.9160	18.3775	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4248	18.7169	19.1303	19.6514	20.0364	20.2272	20.2729	20.2653	20.1304	19.6019	18.9160	18.3775	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9905	0.9778	0.9508	0.8798	0.7481	0.5618	0.4012	0.4610	0.7208	0.9246	0.9812	0.9925	(94)
Useful gains	921.3503	1154.3027	1333.8389	1469.0807	1388.1938	1048.8876	714.6495	742.3242	1026.2631	1074.1614	938.9548	863.0177	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2854.2519	2787.5433	2544.1243	2149.5824	1664.3987	1116.1719	728.5328	765.7465	1199.1699	1797.2778	2365.8169	2847.0337	(97)
Space heating kWh	1438.0788	1097.5377	900.4523	489.9612	205.4965	0.0000	0.0000	0.0000	0.0000	537.9986	1027.3407	1476.1079	(98a)
Space heating requirement - total per year (kWh/year)												7172.9737	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1438.0788	1097.5377	900.4523	489.9612	205.4965	0.0000	0.0000	0.0000	0.0000	537.9986	1027.3407	1476.1079	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7172.9737	
Space heating per m2											(98c) / (4) =	42.4487	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1864.5034	1467.8006	1505.6368	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8353	0.8943	0.8575	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1557.3303	1312.6771	1291.1113	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2080.8957	1985.6197	1794.4641	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	376.9671	500.6693	374.4946	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	94.2418	125.1673	93.6236	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												313.0327	(107)
Energy for space heating												42.4487	(99)
Energy for space cooling												1.8525	(108)
Total												44.3011	(109)
Fabric Energy Efficiency (TFEE)												44.3	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	74.1600 (1b)	x	2.5500 (2b)	=	189.1080	(1b) - (3b)
First floor	62.7600 (1c)	x	2.8300 (2c)	=	177.6108	(1c) - (3c)
Second floor	32.0600 (1d)	x	2.7500 (2d)	=	88.1650	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	454.8838	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1099	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0100	(17)
Infiltration rate		0.3604	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2793	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3561	0.3492	0.3422	0.3073	0.3003	0.2654	0.2654	0.2584	0.2793	0.3003	0.3142	0.3282	(22b)
Effective ac	0.5634	0.5610	0.5585	0.5472	0.5451	0.5352	0.5352	0.5334	0.5390	0.5451	0.5494	0.5539	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.20)			34.6300	1.1450	39.6527			(27)
half glazed door			3.3200	1.2000	3.9840			(26a)
rl1			0.8100	1.1450	0.9275			(27a)
rl2			0.8100	1.1450	0.9275			(27a)
rl3			0.8100	1.1450	0.9275			(27a)
Heatloss Floor 1			74.1600	0.1300	9.6408	110.0000	8157.6000	(28a)
External Wall 1	182.0696	35.2800	146.7896	0.1800	26.4221	110.0000	16146.8560	(29a)
Wall in roof	43.7000		43.7000	0.1700	7.4290	9.0000	393.3000	(29a)
Dorma Wall	25.1600	2.6700	22.4900	0.1800	4.0482	9.0000	202.4100	(29a)
External Roof	33.5000		33.5000	0.1100	3.6850	9.0000	301.5000	(30)
Green Roof	18.9700		18.9700	0.1400	2.6558	9.0000	170.7300	(30)
Sloped Roof	21.6900	2.4300	19.2600	0.1400	2.6964	9.0000	173.3400	(30)
Total net area of external elements Aum(A, m2)			399.2496					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.9964			(33)
Internal Wall 1			276.5500			9.0000	2488.9500	(32c)
Internal Floor 1			32.0600			18.0000	577.0800	(32d)
Internal Floor 2			62.7600			18.0000	1129.6800	(32d)
Internal Ceiling 1			62.7600			9.0000	564.8400	(32e)
Internal Ceiling 2			32.0600			9.0000	288.5400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	30594.8260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.0559 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.4500	0.2360	5.5342
E3 Sill	16.4100	0.0220	0.3610
E4 Jamb	45.7600	0.0170	0.7779
E5 Ground floor (normal)	35.4200	0.0580	2.0544
E6 Intermediate floor within a dwelling	57.4600	0.0010	0.0575
E16 Corner (normal)	32.5200	0.0600	1.9512
R1 Head of roof window	2.4000	0.2400	0.5760
R2 Sill of roof window	2.4000	0.2400	0.5760
R3 Jamb of roof window	6.0900	0.2400	1.4616
E10 Eaves (insulation at ceiling level)	25.8000	0.0570	1.4706
E12 Gable (insulation at ceiling level)	3.7400	0.0430	0.1608
E13 Gable (insulation at rafter level)	5.7000	0.0430	0.2451
E11 Eaves (insulation at rafter level)	11.1000	0.0180	0.1998

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.4261 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	118.4225 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	84.5755	84.2058	83.8435	82.1416	81.8232	80.3409	80.3409	80.0664	80.9118	81.8232	82.4673	83.1408	(38)
Heat transfer coeff	202.9980	202.6284	202.2660	200.5641	200.2457	198.7634	198.7634	198.4889	199.3344	200.2457	200.8899	201.5633	(39)
Average = Sum(39)m / 12 =												200.5626	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2013	1.1991	1.1970	1.1869	1.1850	1.1763	1.1763	1.1746	1.1796	1.1850	1.1888	1.1928	(40)
HLP (average)												1.1869	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9612	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	85.2165	83.9509	82.1687	78.8826	76.4220	73.6937	72.2199	73.9897	75.9166	78.8361	82.1898	84.9284	(42b)
Hot water usage for other uses													
	44.9557	43.3210	41.6862	40.0514	38.4167	36.7819	36.7819	38.4167	40.0514	41.6862	43.3210	44.9557	(42c)
Average daily hot water use (litres/day)												119.8779	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	130.1722	127.2718	123.8549	118.9341	114.8387	110.4756	109.0019	112.4064	115.9680	120.5223	125.5107	129.8841	(44)
Energy conte	206.1609	181.2334	190.3603	162.8148	154.5950	135.8426	131.8283	139.1826	143.0002	163.5476	178.8131	203.3671	(45)
Energy content (annual)										Total = Sum(45)m =		1990.7459	
Distribution loss (46)m = 0.15 x (45)m													
	30.9241	27.1850	28.5541	24.4222	23.1893	20.3764	19.7742	20.8774	21.4500	24.5321	26.8220	30.5051	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0800	(55)
Total storage loss													
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage													
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	262.9033	232.4846	247.1027	217.7268	211.3374	190.7546	188.5707	195.9250	197.9122	220.2900	233.7251	260.1095	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	262.9033	232.4846	247.1027	217.7268	211.3374	190.7546	188.5707	195.9250	197.9122	220.2900	233.7251	260.1095	(64)
										Total per year (kWh/year) = Sum(64)m =		2658.8419	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.9424	101.2611	108.6887	98.0655	96.7968	89.0973	89.2268	91.6721	91.4772	99.7735	103.3849	113.0135	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.1308	40.9729	33.3214	25.2265	18.8571	15.9199	17.2021	22.3599	30.0114	38.1064	44.4757	47.4129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	508.2209	513.4946	500.2050	471.9129	436.1991	402.6333	380.2092	374.9355	388.2252	416.5173	452.2310	485.7968	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	(71)
Water heating gains (Table 5)													
	153.1484	150.6861	146.0870	136.2021	130.1032	123.7462	119.9285	123.2152	127.0516	134.1041	143.5902	151.8998	(72)
Total internal gains													
	822.4526	820.1062	794.5660	748.2940	700.1119	657.2520	632.2924	635.4631	660.2407	703.6803	755.2495	800.0621	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.7200	11.2829	0.6300	0.7500	0.7700	6.3546	(75)
Southeast	18.7700	36.7938	0.6300	0.7500	0.7700	226.1384	(77)
Southwest	1.8400	36.7938	0.6300	0.7500	0.7700	22.1681	(79)
Northwest	12.3000	11.2829	0.6300	0.7500	0.7700	45.4425	(81)
Northwest	2.4300	16.3666	0.6300	0.7500	1.0000	16.9125	(82)

Solar gains	317.0161	563.2006	832.8698	1137.3890	1370.9497	1403.8950	1335.6537	1154.7213	937.2024	639.1858	383.9226	268.5837	(83)
Total gains	1139.4687	1383.3068	1627.4358	1885.6830	2071.0616	2061.1470	1967.9461	1790.1844	1597.4431	1342.8661	1139.1721	1068.6458	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	41.8653	41.9416	42.0168	42.3733	42.4407	42.7572	42.7572	42.8163	42.6347	42.4407	42.3046	42.1632	
alpha	3.7910	3.7961	3.8011	3.8249	3.8294	3.8505	3.8505	3.8544	3.8423	3.8294	3.8203	3.8109	
util living area													
	0.9893	0.9775	0.9496	0.8793	0.7489	0.5764	0.4333	0.4906	0.7304	0.9248	0.9805	0.9915	(86)
Living	19.5581	19.7697	20.0838	20.4556	20.7315	20.8691	20.9067	20.8989	20.7936	20.4121	19.9090	19.5174	
Non living	18.2358	18.5050	18.8997	19.3565	19.6659	19.8039	19.8310	19.8285	19.7409	19.3179	18.6905	18.1890	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2624	19.7697	20.0838	20.4556	20.7315	20.8691	20.9067	20.8989	20.7936	20.4121	19.9090	19.7248	(87)
Th 2	19.9189	19.9207	19.9224	19.9305	19.9320	19.9390	19.9390	19.9404	19.9363	19.9320	19.9289	19.9257	(88)
util rest of house													
	0.9867	0.9720	0.9374	0.8509	0.6945	0.4947	0.3338	0.3860	0.6537	0.9004	0.9748	0.9894	(89)
MIT 2	19.2479	18.5050	18.8997	19.3565	19.6659	19.8039	19.8310	19.8285	19.7409	19.3179	18.6905	18.5019	(90)
Living area fraction										fLA = Living area / (4) =		0.3255	(91)
MIT	19.5781	18.9166	19.2851	19.7142	20.0127	20.1506	20.1811	20.1769	20.0835	19.6740	19.0871	18.9000	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5781	18.9166	19.2851	19.7142	20.0127	20.1506	20.1811	20.1769	20.0835	19.6740	19.0871	18.9000	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9857	0.9655	0.9285	0.8443	0.6989	0.5117	0.3571	0.4101	0.6653	0.8932	0.9690	0.9868	(94)
Useful gains	1123.1431	1335.5538	1511.0903	1591.9999	1447.4977	1054.7048	702.6752	734.2406	1062.8186	1199.5120	1103.8240	1054.5213	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	3101.4285	2840.1628	2585.9980	2168.9435	1664.5865	1103.2574	711.7938	749.6774	1192.7255	1817.0304	2408.0870	2962.9711	(97)
Space heating kWh	1471.8443	1011.0972	799.7314	415.3994	161.5141	0.0000	0.0000	0.0000	0.0000	459.4337	939.0694	1419.8866	(98a)
Space heating requirement - total per year (kWh/year)												6677.9760	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1471.8443	1011.0972	799.7314	415.3994	161.5141	0.0000	0.0000	0.0000	0.0000	459.4337	939.0694	1419.8866	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6677.9760	
Space heating per m2											(98c) / (4) =	39.5193	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	302.8452	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1471.8443	1011.0972	799.7314	415.3994	161.5141	0.0000	0.0000	0.0000	0.0000	459.4337	939.0694	1419.8866	(98)
Space heating efficiency (main heating system 1)	302.8452	302.8452	302.8452	302.8452	302.8452	0.0000	0.0000	0.0000	0.0000	302.8452	302.8452	302.8452	(210)
Space heating fuel (main heating system)	486.0055	333.8660	264.0726	137.1656	53.3322	0.0000	0.0000	0.0000	0.0000	151.7058	310.0823	468.8490	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.9033	232.4846	247.1027	217.7268	211.3374	190.7546	188.5707	195.9250	197.9122	220.2900	233.7251	260.1095	(64)
Efficiency of water heater												173.5813	(216)
(217)m	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	(217)
Fuel for water heating, kWh/month	151.4583	133.9341	142.3556	125.4322	121.7512	109.8935	108.6354	112.8721	114.0170	126.9088	134.6487	149.8488	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	40.3780	32.3927	29.1660	21.3683	16.5055	13.4851	15.0569	19.5715	25.4214	33.3543	37.6736	41.5002	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2205.0789	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	173.5813	
Water heating fuel used	1531.7558	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	325.8734	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4062.7081	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2205.0789	16.4900	363.6175	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1531.7558	16.4900	252.5865	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	325.8734	16.4900	53.7365	(250)
Additional standing charges			0.0000	(251)
Total energy cost			669.9406	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =		1.1271 (257)
SAP value			81.7296
SAP rating (Section 12)			82 (258)
SAP band			B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2205.0789	0.1558	343.5719	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1531.7558	0.1408	215.7199	(264)
Space and water heating			559.2918	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	325.8734	0.1443	47.0336	(268)
Total CO2, kg/year			606.3254	(272)
CO2 emissions per m2			3.5900	(273)
EI value			96.2030	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	74.1600	(1b)	x 2.5500	(2b) =	189.1080	(1b) - (3b)
First floor	62.7600	(1c)	x 2.8300	(2c) =	177.6108	(1c) - (3c)
Second floor	32.0600	(1d)	x 2.7500	(2d) =	88.1650	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		454.8838	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1099	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0100	(17)
Infiltration rate		0.3604	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2793	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.2000	4.1000	3.9000	3.9000	3.4000	3.6000	3.4000	3.4000	3.7000	3.6000	4.0000	(22)
Wind factor	1.0750	1.0500	1.0250	0.9750	0.9750	0.8500	0.9000	0.8500	0.8500	0.9250	0.9000	1.0000	(22a)
Adj infilt rate	0.3003	0.2933	0.2863	0.2723	0.2723	0.2374	0.2514	0.2374	0.2374	0.2584	0.2514	0.2793	(22b)
Effective ac	0.5451	0.5430	0.5410	0.5371	0.5371	0.5282	0.5316	0.5282	0.5282	0.5334	0.5316	0.5390	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.20)			34.6300	1.1450	39.6527			(27)
half glazed door			3.3200	1.2000	3.9840			(26a)
rl1			0.8100	1.1450	0.9275			(27a)
rl2			0.8100	1.1450	0.9275			(27a)
rl3			0.8100	1.1450	0.9275			(27a)
Heatloss Floor 1			74.1600	0.1300	9.6408	110.0000	8157.6000	(28a)
External Wall 1	182.0696	35.2800	146.7896	0.1800	26.4221	110.0000	16146.8560	(29a)
Wall in roof	43.7000		43.7000	0.1700	7.4290	9.0000	393.3000	(29a)
Dorma Wall	25.1600	2.6700	22.4900	0.1800	4.0482	9.0000	202.4100	(29a)
External Roof	33.5000		33.5000	0.1100	3.6850	9.0000	301.5000	(30)

Green Roof	18.9700		18.9700	0.1400	2.6558	9.0000	170.7300 (30)
Sloped Roof	21.6900	2.4300	19.2600	0.1400	2.6964	9.0000	173.3400 (30)
Total net area of external elements Aum(A, m2)			399.2496				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.9964		(33)
Internal Wall 1			276.5500			9.0000	2488.9500 (32c)
Internal Floor 1			32.0600			18.0000	577.0800 (32d)
Internal Floor 2			62.7600			18.0000	1129.6800 (32d)
Internal Ceiling 1			62.7600			9.0000	564.8400 (32e)
Internal Ceiling 2			32.0600			9.0000	288.5400 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	30594.8260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.0559 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.4500	0.2360	5.5342
E3 Sill	16.4100	0.0220	0.3610
E4 Jamb	45.7600	0.0170	0.7779
E5 Ground floor (normal)	35.4200	0.0580	2.0544
E6 Intermediate floor within a dwelling	57.4600	0.0010	0.0575
E16 Corner (normal)	32.5200	0.0600	1.9512
R1 Head of roof window	2.4000	0.2400	0.5760
R2 Sill of roof window	2.4000	0.2400	0.5760
R3 Jamb of roof window	6.0900	0.2400	1.4616
E10 Eaves (insulation at ceiling level)	25.8000	0.0570	1.4706
E12 Gable (insulation at ceiling level)	3.7400	0.0430	0.1608
E13 Gable (insulation at rafter level)	5.7000	0.0430	0.2451
E11 Eaves (insulation at rafter level)	11.1000	0.0180	0.1998

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.4261 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	118.4225 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	81.8232	81.5121	81.2083	80.6227	80.6227	79.2868	79.7992	79.2868	79.2868	80.0664	79.7992	80.9118	(38)
Heat transfer coeff	200.2457	199.9346	199.6308	199.0452	199.0452	197.7093	198.2217	197.7093	197.7093	198.4889	198.2217	199.3344	(39)
Average = Sum(39)m / 12 =												198.7747	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1850	1.1832	1.1814	1.1779	1.1779	1.1700	1.1730	1.1700	1.1700	1.1746	1.1730	1.1796	(40)
HLP (average)												1.1763	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9612	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	85.2165	83.9509	82.1687	78.8826	76.4220	73.6937	72.2199	73.9897	75.9166	78.8361	82.1898	84.9284	(42b)
Hot water usage for other uses	44.9557	43.3210	41.6862	40.0514	38.4167	36.7819	36.7819	38.4167	40.0514	41.6862	43.3210	44.9557	(42c)
Average daily hot water use (litres/day)												119.8779	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.1722	127.2718	123.8549	118.9341	114.8387	110.4756	109.0019	112.4064	115.9680	120.5223	125.5107	129.8841	(44)
Energy conte	206.1609	181.2334	190.3603	162.8148	154.5950	135.8426	131.8283	139.1826	143.0002	163.5476	178.8131	203.3671	(45)
Energy content (annual)										Total = Sum(45)m =		1990.7459	
Distribution loss (46)m = 0.15 x (45)m	30.9241	27.1850	28.5541	24.4222	23.1893	20.3764	19.7742	20.8774	21.4500	24.5321	26.8220	30.5051	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0800	(55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.9033	232.4846	247.1027	217.7268	211.3374	190.7546	188.5707	195.9250	197.9122	220.2900	233.7251	260.1095	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.9033	232.4846	247.1027	217.7268	211.3374	190.7546	188.5707	195.9250	197.9122	220.2900	233.7251	260.1095	(64)
										Total per year (kWh/year) = Sum(64)m =		2658.8419	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	113.9424	101.2611	108.6887	98.0655	96.7968	89.0973	89.2268	91.6721	91.4772	99.7735	103.3849	113.0135	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1308	40.9729	33.3214	25.2265	18.8571	15.9199	17.2021	22.3599	30.0114	38.1064	44.4757	47.4129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	508.2209	513.4946	500.2050	471.9129	436.1991	402.6333	380.2092	374.9355	388.2252	416.5173	452.2310	485.7968	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	(71)
Water heating gains (Table 5)	153.1484	150.6861	146.0870	136.2021	130.1032	123.7462	119.9285	123.2152	127.0516	134.1041	143.5902	151.8998	(72)
Total internal gains	822.4526	820.1062	794.5660	748.2940	700.1119	657.2520	632.2924	635.4631	660.2407	703.6803	755.2495	800.0621	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.7200	12.4928	0.6300	0.7500	0.7700	7.0359	(75)
Southeast	18.7700	39.1209	0.6300	0.7500	0.7700	240.4409	(77)
Southwest	1.8400	39.1209	0.6300	0.7500	0.7700	23.5701	(79)
Northwest	12.3000	12.4928	0.6300	0.7500	0.7700	50.3152	(81)
Northwest	2.4300	18.1588	0.6300	0.7500	1.0000	18.7646	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	340.1267	543.7990	811.0304	1149.4738	1352.4620	1479.8343	1403.8950	1242.2874	996.3124	675.1474	425.6269	282.7618	(83)
Total gains	1162.5793	1363.9053	1605.5964	1897.7678	2052.5740	2137.0863	2036.1874	1877.7505	1656.5531	1378.8277	1180.8764	1082.8239	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.4407	42.5067	42.5714	42.6966	42.6966	42.9851	42.8740	42.9851	42.9851	42.8163	42.8740	42.6347	
alpha	3.8294	3.8338	3.8381	3.8464	3.8464	3.8657	3.8583	3.8657	3.8657	3.8544	3.8583	3.8423	
util living area	0.9859	0.9739	0.9371	0.8400	0.6655	0.4248	0.2522	0.2930	0.6056	0.8856	0.9713	0.9889	(86)
Living	19.7138	19.8867	20.2247	20.5839	20.8190	20.9072	20.9189	20.9181	20.8691	20.5659	20.0787	19.6757	
Non living	18.4440	18.6631	19.0850	19.5118	19.7587	19.8361	19.8389	19.8413	19.8127	19.5061	18.9144	18.3989	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3421	19.8867	20.2247	20.5839	20.8190	20.9072	20.9189	20.9181	20.8691	20.5659	20.0787	19.8609	(87)
Th 2	19.9320	19.9335	19.9349	19.9377	19.9377	19.9441	19.9416	19.9441	19.9441	19.9404	19.9416	19.9363	(88)
util rest of house	0.9823	0.9673	0.9212	0.8020	0.5959	0.3338	0.1500	0.1834	0.5079	0.8477	0.9627	0.9859	(89)
MIT 2	19.3388	18.6631	19.0850	19.5118	19.7587	19.8361	19.8389	19.8413	19.8127	19.5061	18.9144	18.6759	(90)
Living area fraction									fLA = Living area / (4) =			0.3255	(91)
MIT	19.6653	19.0614	19.4560	19.8608	20.1038	20.1847	20.1904	20.1918	20.1565	19.8510	19.2934	19.0616	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6653	19.0614	19.4560	19.8608	20.1038	20.1847	20.1904	20.1918	20.1565	19.8510	19.2934	19.0616	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9812	0.9604	0.9125	0.7989	0.6075	0.3550	0.1741	0.2093	0.5287	0.8439	0.9558	0.9828	(94)
Useful gains	1140.7336	1309.9413	1465.0529	1516.0465	1246.8869	758.5605	354.5472	393.0514	875.8515	1163.5876	1128.6711	1064.1932	(95)
Ext temp.	5.3000	5.8000	7.7000	10.2000	13.3000	16.3000	18.4000	18.2000	15.5000	11.9000	8.2000	5.3000	(96)
Heat loss rate W	2876.5942	2651.4090	2346.8583	1922.9331	1354.2677	768.0432	354.8936	393.7943	920.6413	1578.1908	2198.9455	2743.1657	(97)
Space heating kWh	1291.4803	901.4663	656.0632	292.9584	79.8913	0.0000	0.0000	0.0000	0.0000	308.4648	770.5975	1249.1556	(98a)
Space heating requirement - total per year (kWh/year)												5550.0773	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1291.4803	901.4663	656.0632	292.9584	79.8913	0.0000	0.0000	0.0000	0.0000	308.4648	770.5975	1249.1556	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5550.0773	
Space heating per m2											(98c) / (4) =	32.8446	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 302.5628 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1291.4803	901.4663	656.0632	292.9584	79.8913	0.0000	0.0000	0.0000	0.0000	308.4648	770.5975	1249.1556	(98)
Space heating efficiency (main heating system 1)	302.5628	302.5628	302.5628	302.5628	302.5628	0.0000	0.0000	0.0000	0.0000	302.5628	302.5628	302.5628	(210)
Space heating fuel (main heating system)	426.8471	297.9436	216.8354	96.8256	26.4049	0.0000	0.0000	0.0000	0.0000	101.9507	254.6901	412.8583	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.9033	232.4846	247.1027	217.7268	211.3374	190.7546	188.5707	195.9250	197.9122	220.2900	233.7251	260.1095	(64)
Efficiency of water heater												173.5721	(216)
(217)m	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	(217)
Fuel for water heating, kWh/month	151.4663	133.9412	142.3631	125.4388	121.7577	109.8993	108.6411	112.8781	114.0230	126.9155	134.6559	149.8567	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	40.3780	32.3927	29.1660	21.3683	16.5055	13.4851	15.0569	19.5715	25.4214	33.3543	37.6736	41.5002	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1834.3557	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	173.5721	
Water heating fuel used	1531.8367	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	325.8734	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3692.0658	(238)

10a. Fuel costs - using BEDF prices (554)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1834.3557	26.0600	478.0331	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1531.8367	26.0600	399.1966	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	325.8734	26.0600	84.9226	(250)
Additional standing charges			0.0000	(251)
Total energy cost			962.1523	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1834.3557	0.1567	287.3738	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1531.8367	0.1408	215.7313	(264)
Space and water heating			503.1051	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	325.8734	0.1443	47.0336	(268)
Total CO2, kg/year			550.1387	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1834.3557	1.5800	2898.2041	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1531.8367	1.5207	2329.5276	(278)
Space and water heating			5227.7317	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	325.8734	1.5338	499.8356	(282)
Total Primary energy kWh/year			5727.5672	(286)

SAP 10 EPC IMPROVEMENTS

19b

Current energy efficiency rating:	B 82
Current environmental impact rating:	A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 88	-42 kg (7.6%)
U Solar photovoltaic panels	+ 4.3	-£ 252	-130 kg (25.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£88	0.25 kg/m²	B 83	A 96
Solar photovoltaic panels	£252	0.77 kg/m²	B 87	A 97
Total Savings	£340	1.01 kg/m²		

Potential energy efficiency rating:	B 87

Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 554 TEST (31 Oct 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£962	£874	£88
Space heating	£478	£499	-£21
Water heating	£399	£290	£109
Lighting	£85	£85	£0
Generated (PV)	-£0	-£252	£252
Total cost of fuels	£962	£622	£340
Total cost of uses	£962	£622	£340
Delivered energy	22 kWh/m²	14 kWh/m²	8 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	3 kg/m²	2 kg/m²	1 kg/m²
Primary energy	34 kWh/m²	22 kWh/m²	11 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	74.1600	(1b) x	2.5500	(2b) =	189.1080	(1b) - (3b)
First floor	62.7600	(1c) x	2.8300	(2c) =	177.6108	(1c) - (3c)
Second floor	32.0600	(1d) x	2.7500	(2d) =	88.1650	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		454.8838	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1099 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0100 (17)
Infiltration rate		0.3604 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2793 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3561	0.3492	0.3422	0.3073	0.3003	0.2654	0.2654	0.2584	0.2793	0.3003	0.3142	0.3282	(22b)
Effective ac	0.5634	0.5610	0.5585	0.5472	0.5451	0.5352	0.5352	0.5334	0.5390	0.5451	0.5494	0.5539	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.20)			34.6300	1.1450	39.6527			(27)
half glazed door			3.3200	1.2000	3.9840			(26a)
rl1			0.8100	1.1450	0.9275			(27a)
rl2			0.8100	1.1450	0.9275			(27a)
rl3			0.8100	1.1450	0.9275			(27a)
Heatloss Floor 1			74.1600	0.1300	9.6408	110.0000	8157.6000	(28a)
External Wall 1	182.0696	35.2800	146.7896	0.1800	26.4221	110.0000	16146.8560	(29a)
Wall in roof	43.7000		43.7000	0.1700	7.4290	9.0000	393.3000	(29a)
Dorma Wall	25.1600	2.6700	22.4900	0.1800	4.0482	9.0000	202.4100	(29a)
External Roof	33.5000		33.5000	0.1100	3.6850	9.0000	301.5000	(30)
Green Roof	18.9700		18.9700	0.1400	2.6558	9.0000	170.7300	(30)
Sloped Roof	21.6900	2.4300	19.2600	0.1400	2.6964	9.0000	173.3400	(30)
Total net area of external elements Aum(A, m2)			399.2496					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.9964			(33)
Internal Wall 1			276.5500			9.0000	2488.9500	(32c)
Internal Floor 1			32.0600			18.0000	577.0800	(32d)
Internal Floor 2			62.7600			18.0000	1129.6800	(32d)
Internal Ceiling 1			62.7600			9.0000	564.8400	(32e)
Internal Ceiling 2			32.0600			9.0000	288.5400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 30594.8260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 181.0559 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.4500	0.2360	5.5342
E3 Sill	16.4100	0.0220	0.3610
E4 Jamb	45.7600	0.0170	0.7779
E5 Ground floor (normal)	35.4200	0.0580	2.0544
E6 Intermediate floor within a dwelling	57.4600	0.0010	0.0575
E16 Corner (normal)	32.5200	0.0600	1.9512
R1 Head of roof window	2.4000	0.2400	0.5760
R2 Sill of roof window	2.4000	0.2400	0.5760
R3 Jamb of roof window	6.0900	0.2400	1.4616
E10 Eaves (insulation at ceiling level)	25.8000	0.0570	1.4706
E12 Gable (insulation at ceiling level)	3.7400	0.0430	0.1608
E13 Gable (insulation at rafter level)	5.7000	0.0430	0.2451
E11 Eaves (insulation at rafter level)	11.1000	0.0180	0.1998

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.4261 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 118.4225 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	84.5755	84.2058	83.8435	82.1416	81.8232	80.3409	80.3409	80.0664	80.9118	81.8232	82.4673	83.1408	(38)
Heat transfer coeff	202.9980	202.6284	202.2660	200.5641	200.2457	198.7634	198.7634	198.4889	199.3344	200.2457	200.8899	201.5633	(39)
Average = Sum(39)m / 12 =												200.5626	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2013	1.1991	1.1970	1.1869	1.1850	1.1763	1.1763	1.1746	1.1796	1.1850	1.1888	1.1928	(40)
HLP (average)												1.1869	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9612 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

85.2165	83.9509	82.1687	78.8826	76.4220	73.6937	72.2199	73.9897	75.9166	78.8361	82.1898	84.9284	(42b)

Hot water usage for other uses

44.9557	43.3210	41.6862	40.0514	38.4167	36.7819	36.7819	38.4167	40.0514	41.6862	43.3210	44.9557	(42c)

Average daily hot water use (litres/day) 119.8779 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.1722	127.2718	123.8549	118.9341	114.8387	110.4756	109.0019	112.4064	115.9680	120.5223	125.5107	129.8841	(44)
Energy conte	206.1609	181.2334	190.3603	162.8148	154.5950	135.8426	131.8283	139.1826	143.0002	163.5476	178.8131	203.3671	(45)
Energy content (annual)										Total = Sum(45)m =		1990.7459	
Distribution loss (46)m = 0.15 x (45)m	30.9241	27.1850	28.5541	24.4222	23.1893	20.3764	19.7742	20.8774	21.4500	24.5321	26.8220	30.5051	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.0000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0800 (55)
Total storage loss

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)

If cylinder contains dedicated solar storage

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss 23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
262.9033	232.4846	245.7070	210.9732	198.5431	178.1479	175.5438	183.8285	192.5093	218.8942	233.7251	260.1095	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector 3.0000 (H1)
Zero-loss collector efficiency 0.8000 (H2)
Collector linear heat loss coefficient 1.8000 (H3)
Collector 2nd order heat loss coefficient 0.0000 (H4)
Collector loop efficiency 0.9000 (H5)
Incidence angle modifier 1.0000 (H6)
Overshading factor 0.8000 (H8)
Overall heat loss coefficient of system 6.5000 (H10)
Heat loss coefficient of collector loop 3.9667 (H11)
Dedicated solar storage volume 75.0000 (H12)
Effective solar volume 75.0000 (H14)
Reference volume 225.0000 (H15)
Storage tank correction coefficient 1.3161 (H16)
Heat delivered to hot water 618.8787 (H24)
Heat delivered to space heating 0.0000 (H29)
Solar input 618.8787

Solar input -0.0000	-16.2157	-58.1336	-79.7782	-103.9853	-95.8843	-95.2542	-83.3636	-57.6126	-28.6513	-0.0000	-0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
262.9033	216.2689	187.5734	131.1950	94.5578	82.2637	80.2896	100.4649	134.8967	190.2429	233.7251	260.1095	(64)
									Total per year (kWh/year) = Sum(64)m =		1974.4907	(64)
Electric shower(s) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

113.9424	101.2611	107.5721	92.6626	86.5613	79.0119	78.8053	81.9950	87.1549	98.6569	103.3849	113.0135	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1308	40.9729	33.3214	25.2265	18.8571	15.9199	17.2021	22.3599	30.0114	38.1064	44.4757	47.4129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	508.2209	513.4946	500.2050	471.9129	436.1991	402.6333	380.2092	374.9355	388.2252	416.5173	452.2310	485.7968	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)													
	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	(71)
Water heating gains (Table 5)													
	153.1484	150.6861	144.5862	128.6981	116.3458	109.7388	105.9211	110.2083	121.0484	132.6033	143.5902	151.8998	(72)
Total internal gains													
	822.4526	820.1062	793.0652	740.7900	686.3546	643.2445	618.2849	622.4562	654.2375	702.1795	755.2495	800.0621	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.7200	11.2829	0.6300	0.7500	0.7700	6.3546	(75)
Southeast	18.7700	36.7938	0.6300	0.7500	0.7700	226.1384	(77)
Southwest	1.8400	36.7938	0.6300	0.7500	0.7700	22.1681	(79)
Northwest	12.3000	11.2829	0.6300	0.7500	0.7700	45.4425	(81)
Northwest	2.4300	16.3666	0.6300	0.7500	1.0000	16.9125	(82)

Solar gains	317.0161	563.2006	832.8698	1137.3890	1370.9497	1403.8950	1335.6537	1154.7213	937.2024	639.1858	383.9226	268.5837	(83)
Total gains	1139.4687	1383.3068	1625.9350	1878.1790	2057.3043	2047.1395	1953.9386	1777.1775	1591.4399	1341.3653	1139.1721	1068.6458	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.8653	41.9416	42.0168	42.3733	42.4407	42.7572	42.7572	42.8163	42.6347	42.4407	42.3046	42.1632	
alpha	3.7910	3.7961	3.8011	3.8249	3.8294	3.8505	3.8505	3.8544	3.8423	3.8294	3.8203	3.8109	
util living area													
	0.9893	0.9775	0.9497	0.8805	0.7517	0.5796	0.4362	0.4938	0.7320	0.9250	0.9805	0.9915	(86)
Living	19.5581	19.7697	20.0831	20.4529	20.7289	20.8681	20.9064	20.8985	20.7926	20.4114	19.9090	19.5174	
Non living	18.2358	18.5050	18.8989	19.3534	19.6633	19.8033	19.8309	19.8283	19.7400	19.3171	18.6905	18.1890	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2624	19.7697	20.0831	20.4529	20.7289	20.8681	20.9064	20.8985	20.7926	20.4114	19.9090	19.7248	(87)
Th 2	19.9189	19.9207	19.9224	19.9305	19.9320	19.9390	19.9390	19.9404	19.9363	19.9320	19.9289	19.9257	(88)
util rest of house													
	0.9867	0.9720	0.9375	0.8522	0.6975	0.4976	0.3361	0.3886	0.6555	0.9007	0.9748	0.9894	(89)
MIT 2	19.2479	18.5050	18.8989	19.3534	19.6633	19.8033	19.8309	19.8283	19.7400	19.3171	18.6905	18.5019	(90)
Living area fraction									fLA = Living area / (4) =			0.3255	(91)
MIT	19.5781	18.9166	19.2843	19.7113	20.0101	20.1498	20.1809	20.1766	20.0826	19.6733	19.0871	18.9000	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5781	18.9166	19.2843	19.7113	20.0101	20.1498	20.1809	20.1766	20.0826	19.6733	19.0871	18.9000	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9857	0.9655	0.9287	0.8455	0.7018	0.5147	0.3595	0.4129	0.6670	0.8935	0.9690	0.9868	(94)
Useful gains	1123.1431	1335.5538	1509.9642	1588.0182	1443.8425	1053.5968	702.4222	733.8218	1061.5016	1198.5365	1103.8240	1054.5213	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	3101.4285	2840.1628	2585.8291	2168.3564	1664.0702	1103.1061	711.7573	749.6180	1192.5407	1816.8853	2408.0870	2962.9711	(97)
Space heating kWh													
	1471.8443	1011.0972	800.4435	417.8435	163.8494	0.0000	0.0000	0.0000	0.0000	460.0516	939.0694	1419.8866	(98a)
Space heating requirement - total per year (kWh/year)												6684.0855	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1471.8443	1011.0972	800.4435	417.8435	163.8494	0.0000	0.0000	0.0000	0.0000	460.0516	939.0694	1419.8866	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6684.0855	
Space heating per m2											(98c) / (4) =	39.5555	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	302.8452	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1471.8443	1011.0972	800.4435	417.8435	163.8494	0.0000	0.0000	0.0000	0.0000	460.0516	939.0694	1419.8866	(98)
Space heating efficiency (main heating system 1)													
	302.8452	302.8452	302.8452	302.8452	302.8452	0.0000	0.0000	0.0000	0.0000	302.8452	302.8452	302.8452	(210)
Space heating fuel (main heating system)													
	486.0055	333.8660	264.3078	137.9726	54.1033	0.0000	0.0000	0.0000	0.0000	151.9098	310.0823	468.8490	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	262.9033	216.2689	187.5734	131.1950	94.5578	82.2637	80.2896	100.4649	134.8967	190.2429	233.7251	260.1095	(64)
Efficiency of water heater												173.5813	(216)
(217)m	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	173.5813	(217)
Fuel for water heating, kWh/month													
	151.4583	124.5923	108.0608	75.5813	54.4746	47.3920	46.2548	57.8777	77.7138	109.5987	134.6487	149.8488	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	40.3780	32.3927	29.1660	21.3683	16.5055	13.4851	15.0569	19.5715	25.4214	33.3543	37.6736	41.5002	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.4492	-61.1607	-93.0298	-107.6467	-114.9654	-103.8433	-102.3803	-95.5451	-83.3386	-70.5733	-45.5109	-34.3727	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2207.0963	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	173.5813	
Water heating fuel used	1137.5019	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	80.0000	(231)
Electricity for lighting (calculated in Appendix L)	325.8734	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-952.8159	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2797.6556	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2207.0963	16.4900	363.9502	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1137.5019	16.4900	187.5741	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	325.8734	16.4900	53.7365	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-952.8159	16.4900	-157.1193	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-157.1193	(252)
Total energy cost			461.3334	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7761	(257)
SAP value	87.4186	
SAP rating (Section 12)	87	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2207.0963	0.1558	343.8528	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1137.5019	0.1456	165.6020	(264)
Space and water heating			509.4548	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	325.8734	0.1443	47.0336	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-952.8159	0.1343	-127.9480	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-127.9480	(269)
Total CO2, kg/year			439.6374	(272)
CO2 emissions per m2			2.6000	(273)
EI value			97.2469	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	74.1600 (1b)	x	2.5500 (2b)	=	189.1080	(1b) - (3b)
First floor	62.7600 (1c)	x	2.8300 (2c)	=	177.6108	(1c) - (3c)
Second floor	32.0600 (1d)	x	2.7500 (2d)	=	88.1650	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	454.8838	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1099	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0100	(17)
Infiltration rate		0.3604	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2793	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.2000	4.1000	3.9000	3.9000	3.4000	3.6000	3.4000	3.4000	3.7000	3.6000	4.0000	(22)
Wind factor	1.0750	1.0500	1.0250	0.9750	0.9750	0.8500	0.9000	0.8500	0.8500	0.9250	0.9000	1.0000	(22a)
Adj infilt rate	0.3003	0.2933	0.2863	0.2723	0.2723	0.2374	0.2514	0.2374	0.2374	0.2584	0.2514	0.2793	(22b)
Effective ac	0.5451	0.5430	0.5410	0.5371	0.5371	0.5282	0.5316	0.5282	0.5282	0.5334	0.5316	0.5390	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
windows (Uw = 1.20)			34.6300	1.1450	39.6527			(27)
half glazed door			3.3200	1.2000	3.9840			(26a)
rl1			0.8100	1.1450	0.9275			(27a)
rl2			0.8100	1.1450	0.9275			(27a)
rl3			0.8100	1.1450	0.9275			(27a)
Heatloss Floor 1			74.1600	0.1300	9.6408	110.0000	8157.6000	(28a)
External Wall 1	182.0696	35.2800	146.7896	0.1800	26.4221	110.0000	16146.8560	(29a)
Wall in roof	43.7000		43.7000	0.1700	7.4290	9.0000	393.3000	(29a)
Dorma Wall	25.1600	2.6700	22.4900	0.1800	4.0482	9.0000	202.4100	(29a)
External Roof	33.5000		33.5000	0.1100	3.6850	9.0000	301.5000	(30)
Green Roof	18.9700		18.9700	0.1400	2.6558	9.0000	170.7300	(30)
Sloped Roof	21.6900	2.4300	19.2600	0.1400	2.6964	9.0000	173.3400	(30)
Total net area of external elements Aum(A, m2)			399.2496					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.9964			(33)
Internal Wall 1			276.5500			9.0000	2488.9500	(32c)
Internal Floor 1			32.0600			18.0000	577.0800	(32d)
Internal Floor 2			62.7600			18.0000	1129.6800	(32d)
Internal Ceiling 1			62.7600			9.0000	564.8400	(32e)
Internal Ceiling 2			32.0600			9.0000	288.5400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	30594.8260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.0559 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	23.4500	0.2360	5.5342
E3 Sill	16.4100	0.0220	0.3610
E4 Jamb	45.7600	0.0170	0.7779
E5 Ground floor (normal)	35.4200	0.0580	2.0544
E6 Intermediate floor within a dwelling	57.4600	0.0010	0.0575
E16 Corner (normal)	32.5200	0.0600	1.9512
R1 Head of roof window	2.4000	0.2400	0.5760
R2 Sill of roof window	2.4000	0.2400	0.5760
R3 Jamb of roof window	6.0900	0.2400	1.4616
E10 Eaves (insulation at ceiling level)	25.8000	0.0570	1.4706
E12 Gable (insulation at ceiling level)	3.7400	0.0430	0.1608
E13 Gable (insulation at rafter level)	5.7000	0.0430	0.2451
E11 Eaves (insulation at rafter level)	11.1000	0.0180	0.1998

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.4261	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	118.4225	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	81.8232	81.5121	81.2083	80.6227	80.6227	79.2868	79.7992	79.2868	79.2868	80.0664	79.7992	80.9118	(38)
Heat transfer coeff	200.2457	199.9346	199.6308	199.0452	199.0452	197.7093	198.2217	197.7093	197.7093	198.4889	198.2217	199.3344	(39)
Average = Sum(39)m / 12 =												198.7747	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1850	1.1832	1.1814	1.1779	1.1779	1.1700	1.1730	1.1700	1.1700	1.1746	1.1730	1.1796	(40)
HLP (average)												1.1763	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9612 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

85.2165	83.9509	82.1687	78.8826	76.4220	73.6937	72.2199	73.9897	75.9166	78.8361	82.1898	84.9284	(42b)

Hot water usage for other uses

44.9557	43.3210	41.6862	40.0514	38.4167	36.7819	36.7819	38.4167	40.0514	41.6862	43.3210	44.9557	(42c)

Average daily hot water use (litres/day) 119.8779 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.1722	127.2718	123.8549	118.9341	114.8387	110.4756	109.0019	112.4064	115.9680	120.5223	125.5107	129.8841	(44)
Energy conte	206.1609	181.2334	190.3603	162.8148	154.5950	135.8426	131.8283	139.1826	143.0002	163.5476	178.8131	203.3671	(45)
Energy content (annual)										Total = Sum(45)m =		1990.7459	
Distribution loss (46)m = 0.15 x (45)m	30.9241	27.1850	28.5541	24.4222	23.1893	20.3764	19.7742	20.8774	21.4500	24.5321	26.8220	30.5051	(46)

Water storage loss:

Store volume 200.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 2.0000 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 1.0800 (55)

Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.9033	232.4846	245.7070	210.9732	198.5431	178.1479	175.5438	183.8285	192.5093	218.8942	233.7251	260.1095	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector 3.0000 (H1)

Zero-loss collector efficiency 0.8000 (H2)

Collector linear heat loss coefficient 1.8000 (H3)

Collector 2nd order heat loss coefficient 0.0000 (H4)

Collector loop efficiency 0.9000 (H5)

Incidence angle modifier 1.0000 (H6)

Overshading factor 0.8000 (H8)

Overall heat loss coefficient of system 6.5000 (H10)

Heat loss coefficient of collector loop 3.9667 (H11)

Dedicated solar storage volume 75.0000 (H12)

Effective solar volume 75.0000 (H14)

Reference volume 225.0000 (H15)

Storage tank correction coefficient 1.3161 (H16)

Heat delivered to hot water 661.6016 (H24)

Heat delivered to space heating 0.0000 (H29)

Solar input												661.6016	
Solar input	-0.0000	-15.8339	-57.6452	-82.4058	-103.9334	-103.1051	-102.3064	-93.0264	-65.1018	-34.8507	-3.3927	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.9033	216.6507	188.0618	128.5673	94.6096	75.0428	73.2373	90.8021	127.4075	184.0435	230.3324	260.1095	(64)
									Total per year (kWh/year) = Sum(64)m =			1931.7679	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)

Heat gains from water heating, kWh/month

113.9424	101.2611	107.5721	92.6626	86.5613	79.0119	78.8053	81.9950	87.1549	98.6569	103.3849	113.0135	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	177.6723	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1308	40.9729	33.3214	25.2265	18.8571	15.9199	17.2021	22.3599	30.0114	38.1064	44.4757	47.4129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	508.2209	513.4946	500.2050	471.9129	436.1991	402.6333	380.2092	374.9355	388.2252	416.5173	452.2310	485.7968	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	55.7284	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	-118.4482	(71)
Water heating gains (Table 5)	153.1484	150.6861	144.5862	128.6981	116.3458	109.7388	105.9211	110.2083	121.0484	132.6033	143.5902	151.8998	(72)
Total internal gains	822.4526	820.1062	793.0652	740.7900	686.3546	643.2445	618.2849	622.4562	654.2375	702.1795	755.2495	800.0621	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.7200	12.4928	0.6300	0.7500	0.7700	7.0359	(75)
Southeast	18.7700	39.1209	0.6300	0.7500	0.7700	240.4409	(77)
Southwest	1.8400	39.1209	0.6300	0.7500	0.7700	23.5701	(79)
Northwest	12.3000	12.4928	0.6300	0.7500	0.7700	50.3152	(81)
Northwest	2.4300	18.1588	0.6300	0.7500	1.0000	18.7646	(82)

Solar gains	340.1267	543.7990	811.0304	1149.4738	1352.4620	1479.8343	1403.8950	1242.2874	996.3124	675.1474	425.6269	282.7618	(83)
Total gains	1162.5793	1363.9053	1604.0956	1890.2638	2038.8166	2123.0788	2022.1799	1864.7436	1650.5499	1377.3269	1180.8764	1082.8239	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

tau	42.4407	42.5067	42.5714	42.6966	42.6966	42.9851	42.8740	42.9851	42.9851	42.8163	42.8740	42.6347	
alpha	3.8294	3.8338	3.8381	3.8464	3.8464	3.8657	3.8583	3.8657	3.8657	3.8544	3.8583	3.8423	
util living area													
	0.9859	0.9739	0.9373	0.8413	0.6686	0.4274	0.2539	0.2950	0.6073	0.8859	0.9713	0.9889	(86)
Living	19.7138	19.8867	20.2241	20.5817	20.8173	20.9070	20.9188	20.9180	20.8686	20.5654	20.0787	19.6757	
Non living	18.4440	18.6631	19.0842	19.5094	19.7573	19.8359	19.8389	19.8413	19.8124	19.5055	18.9144	18.3989	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3421	19.8867	20.2241	20.5817	20.8173	20.9070	20.9188	20.9180	20.8686	20.5654	20.0787	19.8609	(87)
Th 2	19.9320	19.9335	19.9349	19.9377	19.9377	19.9441	19.9416	19.9441	19.9441	19.9404	19.9416	19.9363	(88)
util rest of house													
	0.9823	0.9673	0.9214	0.8035	0.5990	0.3359	0.1510	0.1847	0.5095	0.8480	0.9627	0.9859	(89)
MIT 2	19.3388	18.6631	19.0842	19.5094	19.7573	19.8359	19.8389	19.8413	19.8124	19.5055	18.9144	18.6759	(90)
Living area fraction										fLA = Living area / (4) =		0.3255	(91)
MIT	19.6653	19.0614	19.4552	19.8584	20.1023	20.1845	20.1904	20.1918	20.1562	19.8504	19.2934	19.0616	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6653	19.0614	19.4552	19.8584	20.1023	20.1845	20.1904	20.1918	20.1562	19.8504	19.2934	19.0616	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9812	0.9604	0.9127	0.8003	0.6105	0.3572	0.1753	0.2108	0.5303	0.8442	0.9558	0.9828	(94)
Useful gains	1140.7336	1309.9413	1463.9989	1512.8000	1244.7503	758.3177	354.5360	393.0282	875.3164	1162.7966	1128.6711	1064.1932	(95)
Ext temp.	5.3000	5.8000	7.7000	10.2000	13.3000	16.3000	18.4000	18.2000	15.5000	11.9000	8.2000	5.3000	(96)
Heat loss rate W													
	2876.5942	2651.4090	2346.7017	1922.4630	1353.9733	768.0089	354.8913	393.7899	920.5674	1578.0751	2198.9455	2743.1657	(97)
Space heating kWh													
	1291.4803	901.4663	656.7309	294.9574	81.2619	0.0000	0.0000	0.0000	0.0000	308.9671	770.5975	1249.1556	(98a)
Space heating requirement - total per year (kWh/year)												5554.6169	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1291.4803	901.4663	656.7309	294.9574	81.2619	0.0000	0.0000	0.0000	0.0000	308.9671	770.5975	1249.1556	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5554.6169	
Space heating per m2											(98c) / (4) =	32.8714	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												302.5628	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1291.4803	901.4663	656.7309	294.9574	81.2619	0.0000	0.0000	0.0000	0.0000	308.9671	770.5975	1249.1556	(98)
Space heating efficiency (main heating system 1)													
	302.5628	302.5628	302.5628	302.5628	302.5628	0.0000	0.0000	0.0000	0.0000	302.5628	302.5628	302.5628	(210)
Space heating fuel (main heating system)													
	426.8471	297.9436	217.0561	97.4863	26.8579	0.0000	0.0000	0.0000	0.0000	102.1167	254.6901	412.8583	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	262.9033	216.6507	188.0618	128.5673	94.6096	75.0428	73.2373	90.8021	127.4075	184.0435	230.3324	260.1095	(64)
Efficiency of water heater												173.5721	(216)
(217)m	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	173.5721	(217)
Fuel for water heating, kWh/month													
	151.4663	124.8188	108.3479	74.0714	54.5074	43.2344	42.1942	52.3137	73.4032	106.0329	132.7012	149.8567	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	40.3780	32.3927	29.1660	21.3683	16.5055	13.4851	15.0569	19.5715	25.4214	33.3543	37.6736	41.5002	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.1601	-59.3972	-90.2241	-106.0822	-111.2922	-106.3407	-104.6877	-99.2572	-86.6690	-72.6267	-49.6194	-36.1164	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1835.8561	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	173.5721	
Water heating fuel used	1112.9481	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	80.0000	(231)
Electricity for lighting (calculated in Appendix L)	325.8734	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-965.4729	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)

Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2389.2047	(238)

10a. Fuel costs - using BEDF prices (554)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1835.8561	26.0600	478.4241	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1112.9481	26.0600	290.0343	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	325.8734	26.0600	84.9226	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-965.4729	26.0600	-251.6022	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-251.6022	(252)
Total energy cost			622.6267	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1835.8561	0.1566	287.5844	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1112.9481	0.1461	162.5954	(264)
Space and water heating			450.1798	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	325.8734	0.1443	47.0336	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-965.4729	0.1342	-129.5316	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-129.5316	(269)
Total CO2, kg/year			378.7788	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1835.8561	1.5799	2900.4842	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1112.9481	1.5404	1714.4238	(278)
Space and water heating			4614.9080	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	325.8734	1.5338	499.8356	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-965.4729	1.4958	-1444.1796	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1444.1796	(283)
Total Primary energy kWh/year			3791.5880	(286)

Predicted Energy Assessment

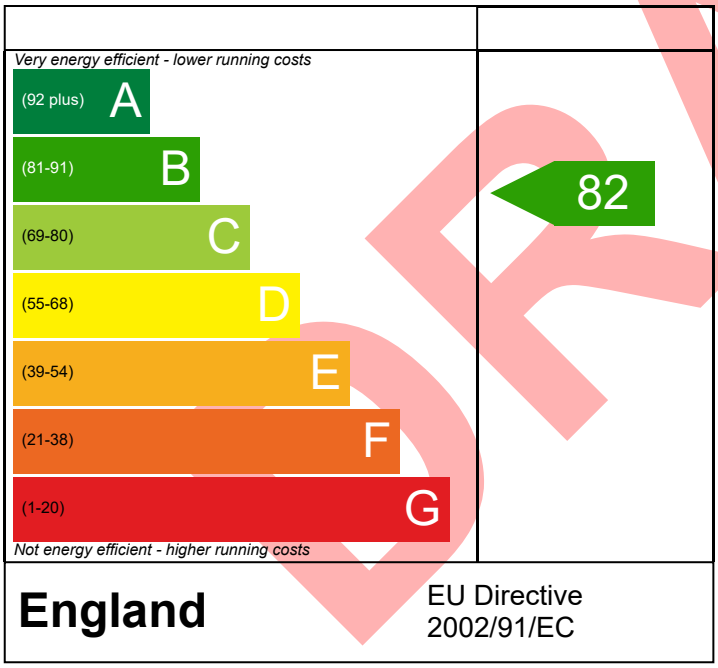
19b, Mendelik Road, London, NW2 3RJ

Dwelling type:	House, Detached
Date of assessment:	02/12/2024
Produced by:	Darren Coham
Total floor area:	168.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

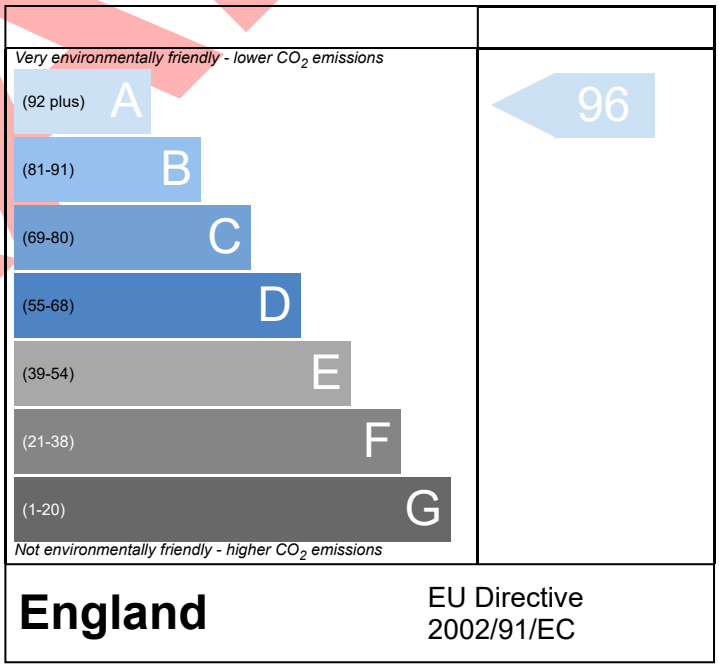
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data

elmhurst energy

Property Reference	19b	**Issued on Date**	02/12/2024
Assessment Reference	19b	**Prop Type Ref**	19b
Property	19b, Mendelik Road, London, NW2 3RJ		

SAP Rating	82 B	**DER**	3.67	**TER**	10.23
Environmental	96 A	**% DER < TER**			64.13
CO_2 Emissions (t/year)	0.55	**DFEE**	43.60	**TFEE**	44.30
Compliance Check	See BREL	**% DFEE < TFEE**			1.59
% DPER < TPER	28.92	**DPER**	38.12	**TPER**	53.63

Assessor Details	Mr. Darren Coham	**Assessor ID**	R789-0001
Client	RT, RT Architectural Consultants		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	Northwest	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	House, Detached	
2.0 Number of Storeys	3	
3.0 Date Built	2024	
4.0 Sheltered Sides	3	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	181.06	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	No	

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	35.42 m	74.16 m²	2.55 m
1st Storey:	32.42 m	62.76 m²	2.83 m
2nd Storey:	25.04 m	32.06 m²	2.75 m

8.0 Living Area	55.00	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall 1	Cavity Wall	Cavity wall; plasterboard on dabs or battens, lightweight aggregate block, filled cavity, any outside structure	0.18	110.00	182.07	146.82	0.00	None	35.25	Calculate Wall Area
Wall in roof	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	43.70	43.70	0.50	Room In Roof	0.00	Enter Gross Area
Dorma Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	25.16	22.50	0.00	None	2.66	Enter Gross Area

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	276.55

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	33.50	33.50	None	0.00	Calculate Wall Area	0.00
Green Roof	External Flat Roof	Plasterboard, insulated flat roof	0.14	9.00	18.97	18.97	None	0.00	Enter Gross Area	0.00
Sloped Roof	External Slope Roof	Plasterboard, insulated slope	0.14	9.00	21.69	19.25	None	0.00	Enter Gross Area	2.44

10.2 Internal Ceilings

Description	Storey	Construction	Area (m²)
Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	62.76
Internal Ceiling 2	+1	Plasterboard ceiling, carpeted chipboard floor	32.06

11.0 Heat Loss Floors

Summary for Input Data

elmhurst energy

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.13	None	0.00	110.00	74.16

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	32.06
Internal Floor 2		Plasterboard ceiling, carpeted chipboard floor	9.00	62.76

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.75	1.20
roof windows	Manufacturer	Roof Window	Double Low-E Soft 0.05			0.63		0.75	1.20
half glazed door	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.75	1.20
door	Manufacturer	Solid Door				0.00			1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
ED	half glazed door	External Wall 1	North West	3.32	
w1	windows	External Wall 1	North West	5.22	
fw1	windows	External Wall 1	North West	5.22	
fw2	windows	External Wall 1	North West	0.93	
fw3	windows	External Wall 1	North West	0.93	
rl1	roof windows	Sloped Roof	North West	0.81	45
rl2	roof windows	Sloped Roof	North West	0.81	45
rl3	roof windows	Sloped Roof	North West	0.81	45
bf1	windows	External Wall 1	South East	12.17	
fw4	windows	External Wall 1	South East	1.30	
fw5	windows	External Wall 1	South East	1.30	
fw6	windows	External Wall 1	South East	1.30	
sw1	windows	Dorma Wall	South East	0.89	
sw2	windows	Dorma Wall	South East	0.89	
sw3	windows	Dorma Wall	South East	0.89	
w2	windows	External Wall 1	South West	0.92	
w3	windows	External Wall 1	North East	0.86	
fw7	windows	External Wall 1	South West	0.92	
fw8	windows	External Wall 1	North East	0.86	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Gov Approved Scheme	23.45	0.24	0.24	Yes
E3 Sill	Gov Approved Scheme	16.41	0.02	0.02	No
E4 Jamb	Gov Approved Scheme	45.76	0.02	0.02	Yes
E5 Ground floor (normal)	Gov Approved Scheme	35.42	0.06	0.06	Yes
E6 Intermediate floor within a dwelling	Gov Approved Scheme	57.46	0.00	0.00	Yes
E16 Corner (normal)	Gov Approved Scheme	32.52	0.06	0.06	Yes
R1 Head of roof window	Table K1 - Default	2.40	0.24	0.24	Yes
R2 Sill of roof window	Table K1 - Default	2.40	0.24	0.24	Yes
R3 Jamb of roof window	Table K1 - Default	6.09	0.24	0.24	Yes
E10 Eaves (insulation at ceiling level)	Gov Approved Scheme	25.80	0.06	0.06	No
E12 Gable (insulation at ceiling level)	Gov Approved Scheme	3.74	0.04	0.04	No
E13 Gable (insulation at rafter level)	Gov Approved Scheme	5.70	0.04	0.04	No
E11 Eaves (insulation at rafter level)	Gov Approved Scheme	11.10	0.02	0.02	No

Y-value	0.04	W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys	0
Number of open flues	0
Number of chimneys/flues attached to closed fire	0
Number of flues attached to solid fuel boiler	0
Number of flues attached to other heater	0
Number of blocked chimneys	0
Number of intermittent extract fans	5
Number of passive vents	0

Summary for Input Data

elmhurst energy

Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Pressure Testing	Yes	
Designed AP_{50}	5.01	$m^3/(h.m^2)$ @ 50 Pa
Test Method	Blower Door	

22.0 Lighting

No Fixed Lighting: No

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	4.00	400.00	25

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	105264	
Fuel Type	Electricity	
In Winter	302.85	
In Summer	173.58	
Model Name	EBLA14DA3V3	
Manufacturer	Daikin Europe NV	
System Type	Heat Pump	
Controls SAP Code	2207	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	Enter value	
Flow Temperature Value	45.00	
25.0 Main Heating 2	None	
26.0 Heat Networks	None	
27.0 Secondary Heating	None	

28.0 Water Heating

Water Heating	Main Heating 1	
SAP Code	901	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
Cold Water Source	From mains	
Bath Count	3	
Immersion Only Heating Hot Water	No	
28.3 Waste Water Heat Recovery System		
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	

Summary for Input Data

Cylinder Volume	200.00	L
Loss	2.00	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store None

34.0 Small-scale Hydro None

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
	£4,000 - £6,000	£88	B 83	A 96
	£3,500 - £5,500	£252	B 87	A 97
			0	0

Thermal Bridging

Property Reference	19b	**Issued on Date**	02/12/2024
Assessment Reference	19b	**Prop Type Ref**	Detached House
Property	19b, Mendelik Road, London, NW2 3RJ		

SAP Rating	82 B	**DER**	3.67	**TER**	10.23
Environmental	96 A	**% DER < TER**			64.13
CO_2 Emissions (t/year)	0.55	**DFEE**	43.60	**TFEE**	44.30
Compliance Check	See BREL	**% DFEE < TFEE**			1.59
% DPER < TPER	28.92	**DPER**	38.12	**TPER**	53.63

Assessor Details	Mr. Darren Coham	**Assessor ID**	R789-0001
Client	RT, RT Architectural Consultants		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Gov Approved Scheme	0.236	23.45	5.53	
External wall	E3 Sill	Gov Approved Scheme	0.022	16.41	0.36	
External wall	E4 Jamb	Gov Approved Scheme	0.017	45.76	0.78	
External wall	E5 Ground floor (normal)	Gov Approved Scheme	0.058	35.42	2.05	
External wall	E6 Intermediate floor within a dwelling	Gov Approved Scheme	0.001	57.46	0.06	
External wall	E16 Corner (normal)	Gov Approved Scheme	0.060	32.52	1.95	
External roof	R1 Head of roof window	Table K1 - Default	0.240	2.40	0.58	
External roof	R2 Sill of roof window	Table K1 - Default	0.240	2.40	0.58	
External roof	R3 Jamb of roof window	Table K1 - Default	0.240	6.09	1.46	
External wall	E10 Eaves (insulation at ceiling level)	Gov Approved Scheme	0.057	25.80	1.47	
External wall	E12 Gable (insulation at ceiling level)	Gov Approved Scheme	0.043	3.74	0.16	
External wall	E13 Gable (insulation at rafter level)	Gov Approved Scheme	0.043	5.70	0.25	
External wall	E11 Eaves (insulation at rafter level)	Gov Approved Scheme	0.018	11.10	0.20	

Total: 268.25 W/mK:

Y-Value: 0.04 W/m²K:

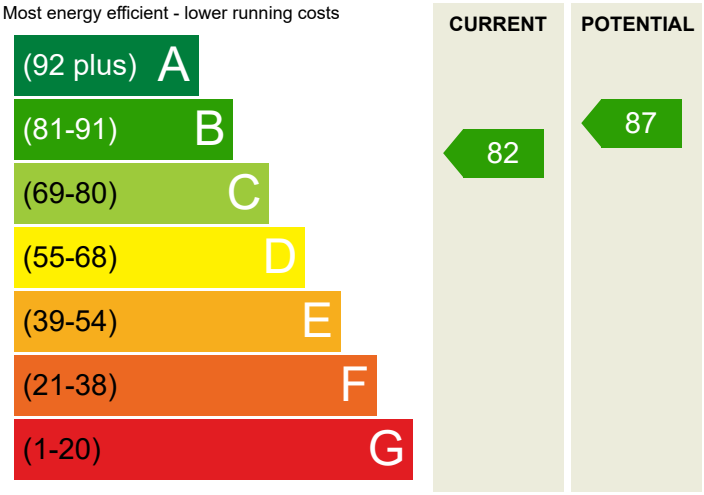
Energy Report

Dwelling Address	19b, Mendelik Road, London, NW2 3RJ
Reference	19b-19b
Assessment Date	02/12/2024
Submission Date	
Property Type	House, Detached
Total Floor Area	169

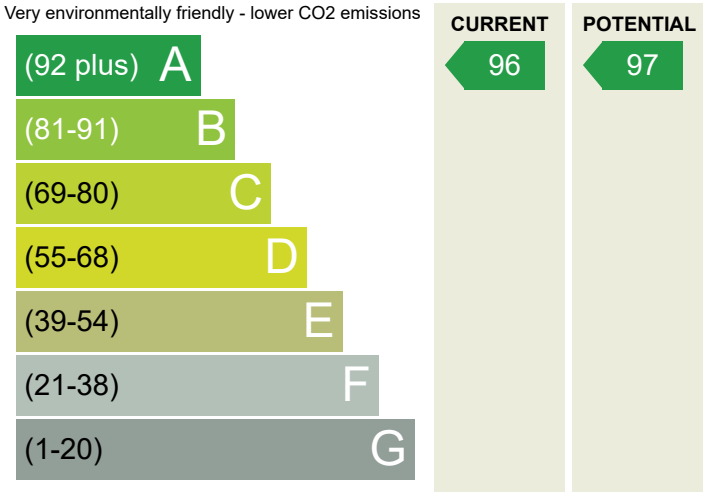
This Energy Report has been generated using the UK's National Calculation Methodology for dwellings, Standard Assessment Procedure (SAP). This methodology is used to assess the energy efficiency of dwellings which is calculated based on a dwelling's heating, hot water, ventilation and lighting usage.

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

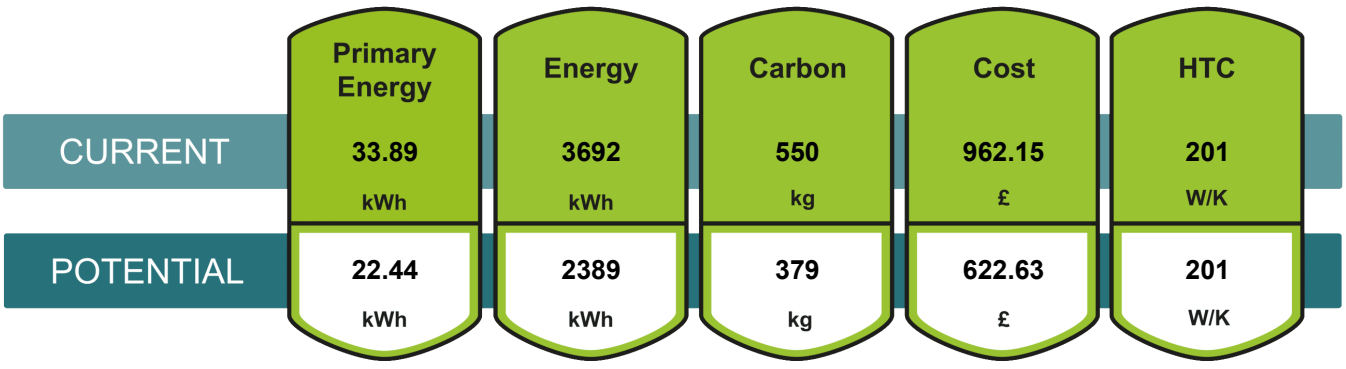
Energy Efficiency Rating



Carbon Dioxide (CO2) Emissions Rating



Additional ratings for your home



Energy Report

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor | Poor | Average | Good | Very Good

Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m²K	Very Good
Roof	Average thermal transmittance 0.13 W/m²K	Very Good
Floor	Average thermal transmittance 0.13 W/m²K	Very Good
Windows	High performance glazing	Very Good
Main heating	Air source heat pump, radiators and underfloor, electric	Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Average
Lighting	Excelent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 5.0 m³/h.m² (assumed)	Good

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling.
To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed.
Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measures	Cumulative savings (per year)	Cumulative rating	Typical costs	Incremental savings (per year)	Cumulative CO2 rating
Solar water heating	£88	B 83	£4,000 - £6,000	£88	A 96
Photovoltaic	£340	B 87	£3,500 - £5,500	£252	A 97

Energy Report

The typical cost is based on average installation prices across the country so may not be representative of the actual costs in your area.

Estimated energy costs of the dwelling

The table below shows the estimated running costs of the space and water heating and lighting within the dwelling. It does not include the energy used from household appliances. The estimated annual costs after potential improvements indicates the total energy cost if all recommended measures named above were installed.

	Estimated annual costs	Estimated annual costs after potential improvements	Potential future savings
Lighting	£85	£85	
Heating	£478	£499	
Hot Water	£399	£290	
New Technologies e.g. Impact of PV	£0	-(£252)	
TOTAL	£962	£623	

Estimated energy use and potential savings

Space Heating
1834
kWh per year

Water Heating
1532
kWh per year

Energy Report

About this document

Created by:	
Company/Trading name:	
Phone number:	
Email address:	

Disclaimer

This Energy Report should not under any circumstances be treated as a Condition Survey and cannot be used to indicate that any element of the dwelling (e.g.heating system) is working correctly.
This Energy Report must not be used in situations where an Energy Performance Certificate (EPC) is required.
This Energy Report is generated from a set of data inputs which may not reflect the actual dimensions, services or construction of the dwelling.
The calculation used to generate this report reflects the SAP Methodology current at the time of report generation.

Glossary terms for additional metrics

Primary Energy	The measure of the energy required for lighting, heating and hot water in a property. This includes the efficiency of the property's heating system, power station efficiency for electricity and the energy used to produce the fuel and deliver it to the property.
Energy Used	The estimated amount of fuel energy for lighting, heating and hot water for the property. The estimate is based on typical usage which is likely to be different to actual consumption.
Carbon (CO2)	The current emissions based on the energy estimates.
Cost	The estimated cost of energy. The cost of each unit of fuel is based on an industry standard which is likely to be different to those the occupier actually pays.
Heat Transfer Coefficient	Heat flow through the property envelope where internal and external temperatures are different.